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VOL. VIII.—No. 1

INDIAN VILLAGE SITE AND
CEMETERY NEAR MADISONVILLE
OHIO

BY
EARNEST A. HOOTON

WITH NOTES ON THE ARTIFACTS BY
CHARLES C. WILLOUGHBY

THIRTY PLATES AND FIVE ILLUSTRATIONS IN THE TEXT

CAMBRIDGE, MASS.
PUBLISHED BY THE MUSEUM
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NOTE

THE explorations which form the basis of the following paper were carried on intermittently under the auspices of the Peabody Museum from 1882 to 1911. During this period, Dr. Charles L. Metz of Madisonville, the discoverer of the site, had general supervision of the work.

By the terms of the will of Miss Phoebe Ferris, the late owner of the land upon which the cemetery is situated, the right to complete the explorations after her death in 1897 was granted the Museum, and the work was then carried on principally by students in the Division of Anthropology, connected with the Museum, under the general oversight of Dr. Metz.

The extensive collections of skeletal remains and artifacts, and more than two hundred and fifty photographs taken during the investigations are in the Museum.

It is hoped that the study of these remains as set forth in the following pages will prove of special value to students of the archaeology of the Ohio region, as it connects the culture of the occupants of this site definitely with the protohistoric and late prehistoric period of the valley.

CAMBRIDGE, MASSACHUSETTS

July 7, 1920

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INDIAN VILLAGE SITE AND CEMETERY NEAR MADISONVILLE, OHIO

THE DISCOVERY OF THE SITE AND HISTORY OF THE EXPLORATIONS

The Discovery. The discoverer of the important Indian village site and cemetery near Madisonville, Ohio, was Dr. Charles L. Metz, a resident of Madisonville, physician by profession, archaeologist by avocation.

Prior to his explorations of the site, Dr. Metz published a paper on the prehistoric monuments of the Little Miami Valley in which he described and located on a chart the principal earthworks and mounds in Columbia, Anderson, and Spencer townships, near the Little Miami River.¹ Group A of Dr. Metz's classification includes the site of the prehistoric cemetery and the neighboring monuments. He describes it as follows:²

Group A is situated partly in section 9, and partly in section 15, Columbia township, Hamilton County, Ohio, one mile west of Plainville station on the Little Miami Railroad, and on the second bottom or plateau of the Little Miami River on a narrow sandy ridge of reddish color.

This ridge has an elevation, averaging from 10 to 25 feet above the general level of the plateau on which it is situated. It lies between the Wooster Turnpike and the Little Miami Railroad and River, elevated about 200 feet above the latter. On this ridge the principal work of this group is situated.

Commencing at the east end of the ridge, and in a wood known as "Stites Grove" we find an earthwork consisting of a circle, central tumulus, and an oval-shaped tumulus impinging on the outer southeast edge of the circle.³

West and to the south of this tumulus, and on the same continuous sand ridge mentioned above, are four or five elevations or tumuli with an average height of three to four feet, being from two to three hundred feet apart. The ridge is here under cultivation; numbers of relics, flint chips, and broken boulders are ploughed up on this ridge.

¹ Charles L. Metz, M.D., *The Prehistoric Monuments of the Little Miami Valley*, Journal of the Cincinnati Society of Natural History, vol. i, no. 3, October, 1878, p. 119 et seq.

² Op. cit., loc. cit.

³ Here Dr. Metz quotes the description and account of the excavation of this work by Florian Giauque, *The Mound Builders*, Harvest Home Magazine, August, 1876.

Northwest of these tumuli, and on the general level of the plateau, one-fourth mile distant, is a mound which has a circumference at the base of 200 feet, and an elevation of 7 feet; it is as yet unexplored, but cultivated annually.

Four hundred yards to the northeast of this mound, and at the junction of the Wooster and Madison turnpikes, can yet be traced a circular work, which has a circumference of 600 feet. . . .

Continuing on to the southwestward of the small tumuli and along the previously described sand ridge, we come to what is known as the "Pottery Field." Here the ridge slopes gently to the south and southeast, with an elevation of from 60 to 80 feet above the level of the Little Miami River. This field is a plateau of about four acres in extent, sloping back to the higher ground. On this plateau fragments of pottery are found in great abundance. Flint chips, arrowpoints, broken boulders, burnt limestone, and shells of the freshwater mussels (Unio) are found all over the surface. Human remains have been found in the adjoining ravines, and on the slopes; the graves were isolated and shallow, and the method of burial was not uniform. Bones of various wild animals are also found.

Two hundred yards north of the pottery field are several small tumuli; the largest has a circumference at base of about 100 feet, height $5\frac{1}{2}$ feet; this mound has been dug into, but not yet explored. The pottery field and also the tumulus are situated in section 9, Columbia township, in what is known as Ferris Woods, in Still Home Hollow.

The pottery field above described was the site of the cemetery later discovered by Dr. Metz. The circumstances of the discovery are as follows. During the fall and winter of 1878-79, Dr. Metz explored several of the mounds of Group A, in the vicinity of the cemetery site.¹

During the progress of the work on this mound [5, Group A] the laborer, employed by Dr. Metz, had been prospecting by digging holes in the surrounding forest, until finally, on the 20th of March, in the southwestern section of the plateau, he came upon a human skeleton at the depth of about two feet; these remains were, however, so much decayed that they could be preserved only in fragments. This was the initiatory step toward a most important archaeological discovery, as further investigation has revealed the interesting fact that the entire plateau is the site of an ancient cemetery, from which have since been exhumed upward of four hundred skeletons of a pre-historic people, accompanied by numerous evidences of their handiwork, in the shape of flint and stone implements, pipes, pottery ware, charred matting and corn, tools and ornaments of bone, shell, and copper, some of which are believed to be unique, all indicating an industrious people, who lived in large communities, and obtained their support by cultivating the soil, as well as by fishing and hunting.²

¹ Charles F. Low, *Archaeological Explorations near Madisonville, Ohio*, Journal of the Cincinnati Society of Natural History, vol. iii, no. 1, April, 1880, p. 40 et seq. (Gives an account of the excavation of the mounds. See also *American Naturalist*, May, 1879, p. 328.)

² Op. cit., p. 43.

The above account corresponds accurately with the data in Dr. Metz's field notes, in which the following entries relative to the discovery occur:¹

March 16, 1879. Britten [the laborer] began digging trenches 4 ft. square and 3 ft. deep and 200 ft. apart, beginning at the Spice Bush Mound (No. 5), and extending in a southwestern direction to the point of the second plain. . . .

March 20. Britten dug 3 pits today, the last one on the southwestern point of the plateau. Just before quitting work he found a skeleton at the depth of 2 ft.

A brief sketch of the discovery was contributed also to Short's *The North Americans of Antiquity*, published in 1879. This account is quoted by Low as follows:²

This cemetery, which is distant about one and one-half miles southeast from Madisonville, occupies the western extremity of a plateau overlooking the Little Miami River, and situated from eighty to one hundred feet above the water-line. It is bounded on the south by the river "bottom," on the north and west by a deep ravine, through which flows a small stream known as Whiskey Run; on the east the plateau slopes gradually up to the general level of the surrounding country, of which it is in fact a continuation or spur, its character of an elevated plateau being derived from its position between the eroded river valley and the deep ravine above referred to. The precipitous but well wooded bluff which forms the southern limit of this plateau extends eastward, facing the river, for perhaps half a mile; and distributed along its edge are a number of mounds and other earthworks; at its base are the Cincinnati and Eastern and Little Miami Railways, the nearest station being Batavia Junction, distant about half a mile east of the cemetery. The original forest still covers the site of the cemetery, and measurements of some of the principal trees are recorded by Dr. Metz. The locality has long been known to local collectors and others interested in archaeological matters as the "Pottery Field," so called on account of the numerous fragments of earthenware strewn over the surface; and it was until recently supposed to be a place where the manufacture of pottery had been carried on by the ancient inhabitants of the valley, the fragments being considered the debris. A few scattered human remains had also been found in the adjoining ravines, but it was not until some time in March, 1879, that its true character and extent as a cemetery were brought to light.

Excavations by Dr. Charles L. Metz. The excavation of the Madisonville cemetery was begun by Dr. Metz on March 20,

¹ Charles L. Metz, Superintendent of Explorations, *Field Notes, 1878-1882*, Archaeological Explorations by the Literary and Scientific Society of Madisonville, O. (Ms. book I, p. 4.) These notes are deposited in the Peabody Museum.

² Op. cit., p. 43 et seq. quoting, J. T. Short, *North Americans of Antiquity*. New York, 1879, pp. 524-525.

1879. The point at which his laborer came upon the cemetery was at the southwestern corner of the plateau bounded on the west by the valley of the little stream called Whiskey Run, and on the south by the bottom lands of the Little Miami River. From this point, Dr. Metz began to trench eastward along the edge of the plateau and his labors were quickly rewarded by the finding of numerous and thickly grouped burials. On the first of April the Madisonville Literary and Historical Society took charge of the work, with Dr. Metz as superintendent of excavations. Successful explorations were conducted on the southwestern slope until June 23, when in accordance with instructions from the society, work was begun on the Stites property known as "Spice Bush Woods." This tract of land was on the eastern portion of the same plateau on which the cemetery was located. During the next two weeks Mound 8 in the Spice Bush Woods was explored and four hut circles were trenched. Further excavations yielded but meager results; and on the 7th of July work was resumed in the old trenches of the cemetery on the Ferris property, and carried on steadily with abundant results up to the end of the year. During this year's work 360 skeletons were exhumed and 176 cache-pits explored; only 31 of these burials and 16 of the cache-pits are plotted upon the plan (plate 30). About 140 earthenware pots and many other specimens were discovered. Toward the end of the year, Dr. Metz inaugurated the system of dividing the areas to be explored into blocks approximately 40 feet square. The boundaries of the blocks were usually determined by trees enclosing roughly square or rectangular spaces, and the burials were located with reference to one or other of these corner trees or other prominent trees within the blocks. All of the excavations prior to the inception of this system were lumped together into one large block. As early as April 12 of the first season, the ground had been staked off by Mr. Low and the principal features sketched. As the excavations in the successive blocks progressed, it is presumed that the burials were plotted on maps, but these maps are not in the possession of the Peabody Museum, nor has the present writer been able to consult them.

Throughout the succeeding year (1880) excavations were continued in the cemetery up to the 18th of December, when the exploration of Block 12 was completed, the local society having

been aided by an appropriation from the Cincinnati Society of Natural History. During this year 239 skeletons were exhumed, 170 cache-pits examined, and over 75 earthenware pots recovered. Such of the burials and cache-pits as could be plotted with a fair degree of accuracy are shown in the plan (plate 30, n). A good deal of work was also done in two kitchen-middens discovered at the heads of ravines, one on the western slope of the plateau, the other on the western slope of the gully which divides the southern portion of the plateau, running north from its edge.

Dr. Metz's work, in 1881, was commenced on the second of March and continued to August 13, when the entries in his field note-book leave off. Block 17 was completed and 58 skeletons and some 84 cache-pits were discovered.

Professor F. W. Putnam visited the site in July of this year and again in September, at which time he made arrangements with the Madisonville Literary and Scientific Society, by which the Peabody Museum, by paying a portion of the expenses of exploration, would receive its share of all that was obtained as the work of excavation progressed. Work was continued by Dr. Metz during the fall, and in February, 1882, Professor Putnam wrote in his report on the Museum:

We have already received the first instalment of the material obtained since the coöperation of the Museum, and information that a second lot has been forwarded to the Museum. Our connection with this work has also resulted in the presentation of many specimens by those who have heretofore sustained the principal cost of the explorations, as will be seen by a reference to the list of additions over the names of Messrs. C. F. Low, P. P. Lane, C. L. Metz, and E. A. Conkling.¹

Excavations by Professor F. W. Putnam. Professor Putnam again visited the cemetery from May 2 to May 16, 1882, during which time the "Putnam Block" was excavated for the Museum. There is deposited in the Museum a small sketch map of this block, apparently made by Dr. Metz, and the note-book in which Professor Putnam recorded the excavations. This block yielded 8 skeletons and several cache-pits and was located near the eastern line of the Ferris property (plate 30, l). During this visit four of the large hut circles on the Stites property northeast of Ferris Wood were explored also.

¹ *Peabody Museum Reports*, vol. iii, p. 67.

Excavations were not carried on in the cemetery except sporadically for some time after Professor Putnam's visit, since he and Dr. Metz began explorations elsewhere in Ohio which continued over a period of several years. In 1891, when Professor Putnam was Chief of the Anthropological Department of the Chicago Exposition, work was again resumed at the Madisonville site under the charge of Dr. Metz, with Harlan I. Smith as assistant, and Block M was excavated on the Stites property for this Department.

Early in 1897 the Museum received notice from Dr. Metz that

Miss Phebe Ferris of Madisonville had bequeathed to the Museum about twenty-five acres of land, on which is situated a large part of the ancient Indian cemetery where, in connection with Dr. Metz, since 1881, the Curator has carried on extensive explorations, and from which place a considerable collection has been made and exhibited in the Museum. This bequest was confirmed by a notice from the executor of Miss Ferris' will. It was known that Miss Ferris was much interested in the explorations on her farm to which she always gave her consent and kindly aid; and it was her expressed desire that the Museum should have the right to continue the work, and that after the explorations were completed the land should be used as a public park, thus marking the site of the ancient village and cemetery.¹

As it was deemed desirable for the Museum to carry on the work of exploration during that year, R. B. Dixon and J. R. Swanton, with Ingersoll Bowditch of the class of 1897, assisted by the coöperation of Dr. Metz, explored a portion of the ground. Mr. Bowditch made a survey and plan of the site which forms the basis of the final plan (plate 30).

Excavations by J. R. Swanton. The account of the excavations conducted in 1897 is derived from the report of J. R. Swanton, his field notes and map, all of which are in the archives of the Museum. Work was carried on from July 27 to October 20.

Mr. Swanton says in his report:

The work was under the general supervision of Dr. C. L. Metz, and under the more immediate charge of Mr. R. B. Dixon and myself, Mr. Dixon taking charge during the first five weeks and myself during the remainder of the time. Mr. Ingersoll Bowditch assisted in the work throughout and executed surveys of the bequest to the Museum and the location of the Indian burial place upon it.

The general location of the Madisonville cemetery is well known to students. . . . The hilltop on which it is situated sinks south to the lower bottom lands of the Little Miami River. On the west it is bounded by a small

¹ *Thirty-first Report of the Peabody Museum*, p. 10.



MADISONVILLE SITE

Portions of Trenches II and III, showing skeletons and positions of pottery vessels found with them, also the distribution of cache-pits, hearths and post-holes. This area is indicated on plate 30 by the rectangle enclosed by broken lines.

steep-sided stream known as Whiskey Run and on the other two sides by less considerable declivities. The extreme eastern portion extends beyond the Museum lot into the Stites estate, but this together with the southern part of the cemetery included in the lot itself has already been explored. Our explorations this summer were consequently the western part of the hilltop toward Whiskey Run. . . . Our trench lines were run bearing N. 58°E. and stakes were driven every ten feet from which to locate the articles discovered. Five trenches were run in all, four of them of the regulation forty feet width and one of twenty feet. The length was determined at one end by the boundaries of previous explorations, at the other by a straight line two hundred feet from the lower line of Trench I which extended to the edge of the hill. Trenches I, II, and half of III were extended to this line but work had to be discontinued before Trenches IV, V, and the second half of III were carried so far.

The soil of this hill was composed of three strata, . . . First came black forest mould two to three feet thick at the edge of the hill and decreasing slowly to one foot and a half or a foot at the upper end of the trenches. Beneath this was four or five feet of hard yellow clay, and underlying all at a depth of perhaps six feet a very deep deposit of sand. On the Stites estate much of the hill had been removed for this sand.

Trench I yielded 67 burials, 71 cache-pits, 7 pots; Trench II, 51 burials, 50 cache-pits, 4 pots; Trench III, 66 burials, 21 cache-pits, 11 pots; Trench IV, 38 burials, 31 cache-pits, 18 pots; Trench V, 3 burials, 4 cache-pits. The total number of skeletons excavated during the season was 230. One hundred and seventy-seven cache-pits and 13 fire places were explored; 42 pots were found. Plate 1 is a copy of a part of Mr. Swanton's plan showing in detail the position of burials and the distribution of cache-pits. The area illustrated is indicated on plate 30 by the rectangle enclosed by broken lines in Trenches II and III.

Excavations by R. E. Merwin. The next exploration of the site was conducted in 1907 by R. E. Merwin, Hemenway Fellow in the Museum, assisted by Irwin Hayden, also Hemenway Fellow. The work continued from July 6 to November 7, 1907. The results of this season's excavations may be summarized from Mr. Merwin's report, maps, and field notes.

Mr. Merwin's Trench A included the tract of land lying between Trench I of the 1897 excavations and the northwestern edge of the plateau as delimited by the banks of the creek, Whiskey Run.

The side of this trench adjoining the previously explored territory is comparatively regular, but the other side is very irregular, due to the meander-

ings of the ravine bank. In size it is 150 feet long, at both ends practically 10 feet wide, its greatest width at the center being approximately 100 feet. The depth necessary to carry the trench to hard-pan varied from 1 to 2 feet.

This trench yielded but 4 skeletons, 15 cache-pits and one hearth. It marks the northern boundary of the cemetery.

Trench B extended northwest from the head of the ravine which divides the southern part of the plateau into east and west portions. The southern and western sides of this trench adjoined land previously explored by Dr. Metz.

Explorations were started in the southeast end of the trench so that the work might be carried forward to a better advantage, for there is a decided elevation in the ground to the northwest. A fifty foot trench was laid out, but owing to the irregularity of the previously explored ground, its width varied from 35 to 75 feet. Its length was 130 feet.

Sixty skeletons were found in this trench. Forty cache-pits and two hearths were explored.

After carrying Trench B forward about 130 feet, it was thought best to start another trench parallel and adjacent to it. But opening the trench in line with the southeast end of Trench B, it was found that former explorations had not been carried this far. So instead of running a trench to the northwest as in the case of Trench B, one was run in an opposite direction, following along a narrow ravine now used as a road. This made an irregular shaped trench; and it was also necessary to vary the width of it in order to take in all the unexplored territory adjoining it. This trench was extended for a distance of 110 feet, the width varying from 30 to 50 feet.

There were found in Trench C, 21 skeletons and 31 cache-pits. A portion of this trench was occupied by a large kitchen-midden which had been partially explored by Dr. Metz in earlier years.

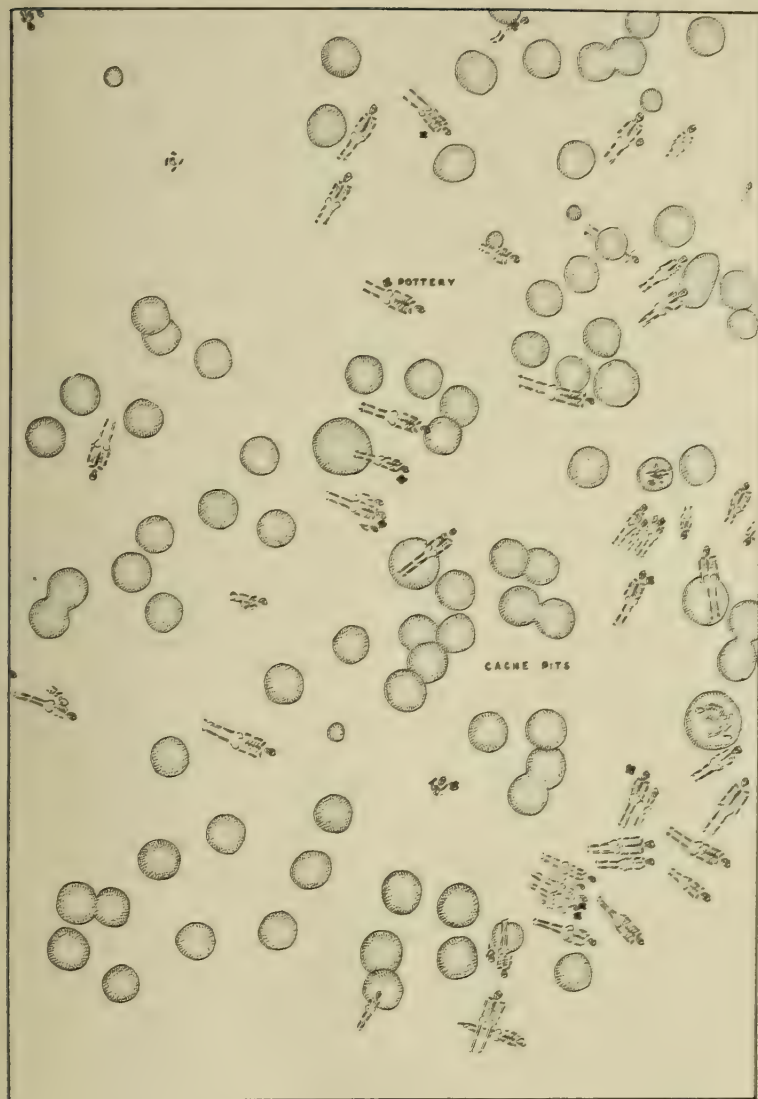
The total finds of the season's work were 85 skeletons, 32 pots, 88 cache-pits, and 3 hearths or fire places.

In the following year (1908) Mr. Merwin excavated in the site of the cemetery from April 1 until September 15, opening three trenches. The portion explored in 1908 was adjacent to that excavated in the latter portion of the season of 1907 (see plate 30).

Trench D was a continuation of Trench C northward, and adjoined Trench B on the west.

As can be seen by the map, this trench had a width of 80 feet, and in general was 180 feet long, with an irregular strip on the south side.

This trench yielded 101 skeletons and 147 cache-pits.



MADISONVILLE SITE

The greater part of Trench D, showing skeletons and the positions of pottery vessels found with them, also the distribution of cache-pits. This area is shown on plate 30 by the rectangle enclosed by broken lines.

Trench E was merely a continuation of Trench B of the explorations of 1907. It varied in width from 35 to 55 feet and extended toward the bluff of the ravine, a distance of 170 feet. As can be seen on the map of this trench the finds were very good in the southern portion, but the northern part is practically devoid of skeletons or cache-pits.

The reason for the barrenness of this portion of the trench is, as can be seen from the general map, because this tract had already been explored. There were 38 skeletons and 41 cache-pits found in this trench.

Trench F was a continuation of Trench D.

Perhaps one of the most striking things in connection with its exploration was the depth at which some of the skeletons were found. Many of them were from 3 ft. 6 in. to 4 ft. below the surface and extended 2 ft. 6 in. to 3 ft. into the hard-pan.

There were 37 skeletons and 59 cache-pits found in this trench.

The total number of skeletons exhumed in the season was 176 and 247 cache-pits and 3 hearths were explored.

Excavations by B. W. Merwin. In 1911 B. W. Merwin, brother of R. E. Merwin, conducted explorations for the Museum in the northeastern portion of the tract. The data in regard to his excavations are derived from his field notes and maps.

Trench G was east of Trench E and north of Trench F and extended N. 76° E. As laid out, the block was 290 feet long and 30 feet wide. Beginning at the west end the trench was excavated 90 feet eastward and a trial trench was dug at its eastern extremity. This trench yielded only 3 skeletons and 7 cache-pits and seems to have marked the northeastern limit of the cemetery.

Trench H ran parallel with Trench G. Its southeastern corner was 200 feet south of the corresponding corner of Trench G. Trench H was 150 feet long and 50 feet wide; it yielded 43 skeletons and 72 cache-pits.

Trench I was 80 feet square and ran parallel and adjacent to Trench H on the south. Trench I contained 26 skeletons, 52 cache-pits, and 23 post-holes.

Trench J was a plot 30 feet by 50 feet laid off north of the eastern portion of Trench H and adjacent to it, and east of Trench I. Several trial trenches were dug in this tract and two cache-pits were discovered.

Trench K was an irregular tract situated on a southern point of the plateau. In this trench were found 12 skeletons and 13 cache-pits.

In addition to the above, Mr. Merwin dug several trial trenches in the tract north of Trench G and south of the plateau edge, and was able to establish the fact that the cemetery did not cover this northern portion of the plateau. Six other trial trenches, dug north of Whiskey Run toward the eastern boundary of the Museum tract gave negative results.

THE BURIALS

Depth of Interments. The depth of the burials varied in the different parts of the cemetery and in individual cases. Usually the graves were dug in the soft leaf mould overlying the hard yellow clay, and did not extend down into the latter. Consequently, where the leaf mould lay thick, the depth of the interments tended to be greater, and where the leaf mould was thin, the graves were likely to be shallow. Naturally, in certain places denudation of the surface soil took place, so that burials were exposed or their original depth decreased. Mr. Swanton says:

The skeletons were usually buried in the lower part of the black mould or the upper part of the hard-pan. The depth was eighteen to twenty-four inches.

Tabulation of the depth of interment of 151 burials (all the skeletons excavated by Dr. Metz in 1879 in which depth was recorded) gives the following result:

Depth	Less than					4 ft.
	12 in.	12-18 in.	19-24 in.	25-36 in.	37-48 in.	
Number of burials . . .	8	53	77	12	0	1
Per cent	5.3	35.1	51.0	8.0	0.0	0.6

This random sample agrees well enough with Mr. Swanton's statement. R. E. Merwin also says:

A few were found in the hard-pan, but for the most part they were resting directly upon the hard-pan or above it in the black soil.

Mr. Merwin notes, however, that in Trench F some of the burials were of unusual depth:

Many of them were 3 ft. 6 in. to 4 ft. below the surface and extended 2 ft. 6 in. to 3 ft. into the hard-pan. Of 37 burials in this trench, 6, or 16.2 per cent.,

were at a depth of more than 3 feet from the highest point of the skull to the surface; 17, or 46 per cent, were between 25 in. and 36 in.; 8, or 21.6 per cent, were between 19 in. and 24 in.; 6, or 16.2 per cent, from 12 in. to 18 in.

Forms of Burial. The following table shows the distribution of forms of burial for 650 skeletons exhumed by Dr. Metz:

	Contracted	Horizontal	Sitting	Collective and disturbed	Total
Number	38	491	32	89	650
Per cent	5.8	75.6	4.9	13.7	100.00

Of 231 skeletons found by Mr. Swanton, 164, or 71 per cent, were extended or horizontal burials; 66, or 28.6 per cent, were collective or disturbed burials; there was but one contracted burial. He says in his report:

The position was invariably full length, except in the cache-pits. Not infrequently a skull with a small pile of long bones would be found beside a regular full length burial. [See plate 3, b.]

Horizontal or Extended Burials. More than 75 per cent of all the burials in the Madisonville cemetery were horizontal or extended burials. In addition to these a large number of the disturbed or "bunched" burials may have been originally extended burials which had been moved to make room for later interments. In most cases the bodies were laid flat upon their backs, with the faces either upward or turned to one side. The arms were usually extended at the sides (plates 3, a, b and 4, b).

Contracted Burials. Dr. Metz records 38, or 6.3 per cent, of his burials as contracted or "in the doubled-up position." Contracted burials seem to have been confined to the southern portion of the cemetery excavated by Dr. Metz, since the subsequent excavators found them only in cases where bodies had been buried in cache-pits and were necessarily flexed.

Burials in Sitting Posture. These were also confined to that portion of the cemetery which Dr. Metz explored. He records 32, or 5 per cent of the skeletons exhumed by him. Of these, all but one were found during the excavations of the first season, and in the first few weeks of the work. Burials in the sitting posture seem, therefore, to have been confined to the extreme southwestern portion of the cemetery.

Collective and Disturbed Burials. The collective burials found seem to have been secondary in character. In certain places a number of old burials may have been cleared away to make room for new ones and the disarticulated bones from the old graves buried in a common pit. Dr. Metz records the following find on April 12, 1879:

A circular excavation, $3\frac{1}{2}$ feet in diameter, was made, and from it were taken twenty-two skeletons. The bottom of this pit was paved with the river mussel shells (*Unio*); over them were the bones of the lower extremities and trunks, and above these the skulls.

Another more typical collective burial, consisting of one articulated skeleton and a miscellaneous heap of bones of several individuals, was found by Dr. Metz, September 24, 1879:

An adult female with small foetal bones in pelvic region, and a confused mass of bones about her lower extremities, among which were five crania, two facing upwards and three downwards.

Finds analogous to the above are reported by all of the excavators (see plate 3). Very commonly odd portions of a disturbed burial were found in a subsequent interment.

In some instances burials were disturbed in order to make room for cache-pits. Dr. Metz on September 3, 1880, reports:

Block 10, skeleton 1, head east, adult male; arms flexed on the humeri. The body was disarticulated at the second lumbar vertebra; the lower extremities together with the pelvis were buried separately, probably to make way for cache-pit 1 of this block.

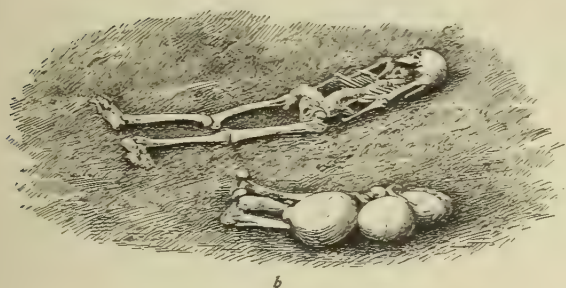
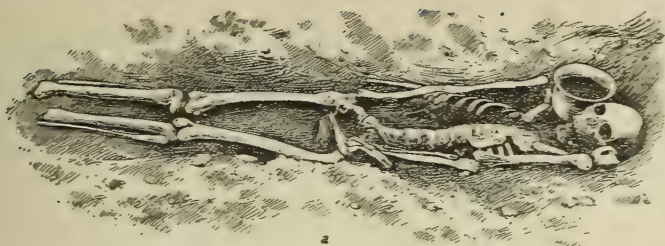
R. E. Merwin makes the following note on skeleton 37 in Trench D:

Adult; ash-pit 71 had been dug through this skeleton, and the portion in the way of the pit had been removed; the parts removed were the right femur, right pelvic bone, sacrum, some of the lower right ribs, right ulna and radius, and about two inches of the distal end of the right humerus, and all of the right finger bones.

Burials disturbed by the digging of cache-pits are not infrequently reported throughout the excavations (see plate 4, a, d).

Burials in Cache-pits. In rare instances bodies were buried in the cache-pits. The first of these burials was recorded by Dr. Metz on January 20, 1880:

Skeleton 3. Block 3, in the bottom of above pit (cache-pit 2), lying on back, face up, head northwest, legs sharply flexed on thighs. The portion of



MADISONVILLE SITE

a, Skeleton 19, Trench IV, showing a common method of burial. A tobacco pipe and food vessel were found near the skull; *b*, Skeletons 1-4, Trench IV, an extended burial and a collective burial of the skulls and principal bones of three individuals; *c*, Collective burial, skeletons 34, 35, Trench H; *d*, Collective burial, skeletons 19-25, Trench H.

the pit surrounding the skeleton and below the layer of charcoal was walled, but not floored, with flat limestones, 10 to 12 inches square, and all distinctly showing the action of fire, having been burnt, however, before being placed in their present position, as the walls and floor of the pit do not show any traces of having been burnt.

Cache-pit 8 in Block 14 contained a calvaria unaccompanied by any other portion of the skeleton.

In Mr. Swanton's excavations, skeletons II, 4, III, 19, and IV, 7 and 8 were buried in cache-pits.

Skeleton III, 19 lay in a rather confused heap near the bottom of cache-pit III, 5. The body seems to have been doubled up, heels on the thighs and the knees drawn up toward the chest. The skull was not in its proper position but lay on the right side. Depth of skeleton, 5 ft. 3 in. Under it was a large stone, and above three others, one a grindstone.

In Mr. Merwin's report on Trench B, he says:

Skeleton 14 was that of an adult buried dorsal side up, in the bottom of cache-pit 15. The walls of the pit had been slightly widened at the bottom to make room for the head and feet. Above the skeleton were the usual contents to be found in cache-pits of this trench.

In regard to the cache-pits of Trench C, he says:

Another noticeable feature was the presence of human bones, and oft-times of entire skeletons, in the pits. In 7 pits there were found human bones — lower jaw, portions of skull, finger and toe bones, etc. In three pits there were bunches of human bones. It seems very probable that when digging a cache-pit a skeleton had been disturbed and the bones placed in a pile over the pit, while that portion of the skeleton not disturbed by the pit was left in its original position.

In Trench E, skeleton 9 was buried in the bottom of cache-pit 1, and above it and separated from it by a stratum of black earth, two to four inches in thickness, were five disarticulated skeletons. Skeleton 24 of this trench was buried in a sitting posture in cache-pit 14.

Burials over cache-pits were also common and in many cases portions of the skeletons above the cache-pit had sunk down into the pit, owing to the settling of the earth underneath.

Anomalous Burials. Writing of a family group of six skeletons (Block 6, 25-30), Dr. Metz says:

The earth above these skeletons was baked hard and of a brick red color in several places with layers of ashes. The leaf mould here was 6 inches deep against 16 inches elsewhere.

Mr. Swanton records a stratum of burnt clay two inches thick, eight inches above skeleton II, 7, and extending all over the body. These burnt areas may well have been fire places.

In Block 12 of Dr. Metz's excavations the head of skeleton 582 rested on a large limestone. Another large limestone was placed over the chest, and one over the thighs just above the knees. The stones showed evidence of having been exposed to the action of fire. Skeletons with the heads pillowed on large flat limestones which had been exposed to the action of fire were occasionally found.

In Trench F the grave of skeleton 10 had been paved with limestone slabs, and both at the head and at the foot of the grave two slabs had been set up on end. On plate 4, a, is shown a grave lined with limestone slabs through which a cache-pit has been dug.

In Trench III, skeletons 33, 35, 36 were laid on blocks of limestone and were also covered with them.

Grouping of Burials. Often a number of burials were arranged in a group in a way that would seem to indicate either simultaneous burial of a number of individuals, or, perhaps, a species of division into family lots.

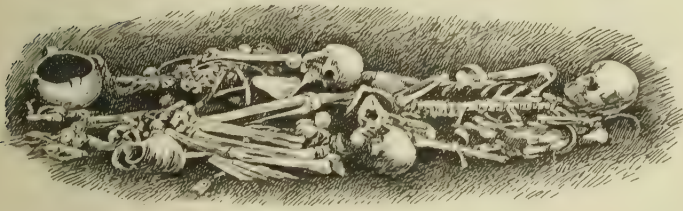
The most common form of grouping consisted in placing horizontal burials side by side and close together, with the heads laid in the same direction. Skeletons 3, 4, and 5 of Block 15 were an adult male in a horizontal position, an adult female parallel and close to the male, and a child of about two years buried in extended posture between the legs of the female with his head resting on the pelvis of the mother. In Block 11, skeleton 25, that of a child, was similarly buried between the legs of an adult female with his head resting on her pelvis. Two feet to the north were the skeletons of three children, one in a horizontal position and the other two in disarticulated heaps on either side of the lower extremities of the extended burial. Fourteen inches to the south of the left ilium of the central adult female burial of the group, was a single adult detached cranium. Another isolated cranium was found fourteen inches to the south of the left tibia of the central burial. North of this same burial and 20 inches from the lower extremities was a heap of bones sufficient to make up two adult skeletons and, as Dr. Metz says: "seemingly the bones of the skeletons



a



b



c



d

MADISONVILLE SITE

a, Skeleton 10, Trench F. The grave was originally lined with limestone slabs. A cache-pit was subsequently dug through the grave; b, Extended burial; c, Grouped burial, skeletons 8-10, Trench B; d, Skeleton 82, Trench D, an extended burial through which a cache-pit has been dug.

belonging to the detached crania." Apparently in this instance one family group had been disturbed in order to make room for the burial of another.

In Block 6 skeletons 25-30 were apparently a family group. They were all horizontal burials on the same level and covered with a layer of baked earth. The adult male was buried underneath the adult female and the children whose ages ranged from 3 to 5 years were on the same level as the mother, but further to the east.

Not infrequently husband and wife were buried side by side or in the same grave, one above the other. An instance of the latter case was found in Block 11 where skeleton 547, an adult male, was buried head to the north, face up, with the tibiae flexed at right angles to the body. An adult female skeleton was buried in a horizontal position with the cranium resting on the thorax of the male.

Block 16 presented an interesting group consisting of a male adult buried in the horizontal position and three immature persons, each buried in the contracted posture on his back, the three superimposed in one grave. This same block included a group in which two adult skeletons, sex not stated, were buried in a contracted position on the lower extremities of an adult male lying in a horizontal position. A good example of a grouped burial is illustrated in plate 4, c.

Orientation of Burials. The following table shows the direction in which the head was laid in 453 burials of which the orientation was recorded by Dr. Metz:

	N.	S.	E.	W.	NE.	SE.	NW.	SW.	Total
Number	35	139	122	13	37	80	15	12	453
Per cent	7.7	30.6	26.9	2.8	8.1	17.6	3.3	2.6	100.00

It will be observed from the above that the bodies were laid in all directions, but prevailingly with heads toward the south, the east, and the southeast. Three hundred and forty-one, or 75.2 per cent, of 453 burials were orientated in this general direction. Mr. Swanton says in his report:

The bodies were laid with the heads in all directions. The great majority have their heads bearing east, while south seems to be the next most popular direction.

The following table summarizes the orientation of Mr. Swanton's burials:

	N.	S.	E.	W.	NE.	SE.	NW.	SW.	Total
Number	2	4	21	0	62	55	11	14	169
Per cent	1.2	2.4	12.4	0.0	36.7	32.5	6.5	8.2	100.00

The apparent result seems superficially not to agree with that obtained by Dr. Metz since the table shows very few burials with heads south and a larger number with heads northeast. This difference, however, is probably due to the fact that Dr. Metz merely estimated his orientations, whereas Mr. Swanton and subsequent excavators took their bearings accurately with a compass. Consequently very few burials are recorded as due north and due south and none due west. On the other hand 12.4 per cent were due east.

Eighty-one and six-tenths per cent of the burials recorded by Mr. Swanton were orientated east, northeast, or southeast.

Objects Associated with the Burials. This section deals with the finds in the cemetery only in relation to the burials.

The following table shows the number of pots found by the principal excavators and recorded in the field notes deposited in the Peabody Museum. It also indicates the position of the pots with reference to the body, where found in association with burials, and mentioned by the investigators.

	Number of pots	Head	Feet	Right side	Left side	Between knees
Dr. Metz	228	137	11	4	11	3
J. E. Swanton	46	26	0	5	4	3
R. E. Merwin	72	49	1	6	7	6
B. W. Merwin	7	7	0	0	0	0
F. W. Putnam	1	1	0	0	0	0
Total	354	219	12	15	22	12

Of 354 pots recorded to have been found by the excavators, their position, in relation to the body, is stated in 280 instances. Of the remainder practically all were found with skeletons, but in the first year of his excavations Dr. Metz frequently omitted to note the position of the pots in relation to the associated burials.

It will be observed that in the vast majority of cases the pots were found at the head, either above the vertex or to the left or right without apparent distinction.

About 28 per cent of the entire number of burials recorded had pots associated with them, usually one pot to a burial. The pottery finds were more numerous by far in the southwestern portion of the cemetery excavated by Dr. Metz in 1879. In the northwestern portion excavated by the Merwin brothers, pots and artifacts of all kinds were rare.

The pots were buried with individuals of both sexes and of all ages without distinction. Mr. Swanton says:

As a rule one unio shell was found in each pot, seeming to indicate that it contained — if indeed it contained anything — something of a liquid nature. These pots were frequently such as had been broken around the rims before burial.

R. E. Merwin also states that an examination of the contents of the pots usually showed one or more unio shells and a few small fragments of animal bones. All of the investigators found occasional pots containing traces of red ocher.

It is perhaps worthy of note that on April 1, 1879, Dr. Metz found a pit containing four crania and four pots. One of these pots was inverted and rested on a skull.

Stone implements were frequently found in the burials. These included adze blades, grooveless axes, hammers, scrapers, arrow and spear points, chisels, knives, and perforated disks. Finds of stone implements in the burials seem to have been far more common in the southwestern portion of the cemetery, first excavated by Dr. Metz, than in his later explorations and those of the subsequent excavators. The majority of the implements seem to have been found in the cache-pits and kitchen-middens, and in the leaf mould, rather than in the graves. Arrowpoints, grooveless axes and knives were the commonest implements found with the bodies. In several instances arrowpoints were found embedded in portions of the skeletons. On April 12, 1879, Dr. Metz found a collective burial consisting of 22 skeletons.

A sacrum belonging to one of these skeletons had imbedded in the anterior surface near the upper border a flint arrowhead, which in order to reach that position in the living body must have passed through the abdominal walls and intestines in an oblique direction, from above downwards and to the right.

On July 10 of the same year the skeleton of an adult was exhumed, one of the dorsal vertebrae of which had a flint arrow-

point embedded in its dorsal aspect. Mr. Swanton and Mr. Merwin record similar finds.

Pipes of limestone or catlinite were often found with the skeletons of males. Dr. Metz mentions 47 of these in his field notes, and it is probable that he found many more than that number. Mr. Swanton says that he found 18 complete pipes, and twice as many broken ones. Pipes were usually found clasped in the hand or laid by the neck.

On June 6, 1879, Dr. Metz discovered a burial with which were associated "two inscribed stones," one of which seems to have been incised with double-pointed arrow designs, and the other with checker-board pattern.

Bone objects commonly found with the burials were beads, cylinders, scrapers or gouges, and awls. Miscellaneous unworked animal bones frequently occurred with the human burials.

Aside from unio shells which were commonly found in the pots and loose in the graves, objects of shell were rare in the burials. There occurred, however, shell beads, disks, pendants, perforated box tortoise shells, and at least one ornamented shell spoon. (Metz, skeleton 222, 1879.) Other objects found with the skeletons include points, cylinders, harpoons, arrow straighteners, combs, and arm-bands.

Ornaments of copper and pieces of hammered copper were found alike in graves and cache-pits, in the kitchen-middens, and among the surface relics. Dr. Metz records the finding of more than 50 flat pieces of copper, 40 copper rolls or beads, 5 strips of copper, also many beads, rings, and one copper cross. Mr. Swanton and Mr. Merwin also found many copper beads and hammered strips with the burials.

Objects of iron in the burials were exceedingly rare. On December 17, 1880, Dr. Metz discovered the skeleton of an adult female (Block 12, 597), over the chest of which was placed "a piece of iron resembling a sword hilt" (plate 18, t). Mr. Swanton found a skeleton (I, 40), with which was associated an iron bead or cylinder (plate 18, s) embedded in the deerskin. These seem to be the only cases in which the association of iron with the burials was definite. Several pieces were found in the leaf mould and also in the cache-pits.

Mr. Swanton states that blue glass beads, apparently of European origin, were found about the head of skeleton I, 39. A few small shell beads were found with the glass beads. Fragments of the same kind of glass beads were also found by Mr. Swanton in three of the cache-pits. These glass beads were not found by the other excavators, with the exception of Mr. B. W. Merwin, who found one in a cache-pit.

Lumps of cannel coal were found with comparative frequency in the burials. In some instances the pottery vessels contained red ocher. Dr. Metz records a burial (Block 7, 1) in which a handful of charred corn was found about the cranium. Bird crania used for pendants, and animal teeth pierced for suspension or for stringing, were also found in the graves.

Burials of Special Interest. Certain burials deserve special mention, either because of some anomalous feature, or because of the special interest of the associated objects. Some of these have already been mentioned, and others, which seemed of special importance to the investigators, will be described briefly here.

In Trench I of Mr. Swanton's excavations, skeleton 60 was associated with some interesting finds:

These consisted of several copper plates one and a half by two inches square which had been clasped around deer hide still preserved with the hair on it by action of the copper. With these plates were found a number of shell beads made from the inner whorls of univalves, two or three copper beads, etc. A very small sea shell which had been rubbed down in some way and discolored by ocher, was identified as *Marginella apicina*, a variety of shell from the Gulf Coast and the Carolinas. All these articles were between the thigh bones of the skeleton.

Grave 18 of Mr. R. E. Merwin's Trench D.

This grave, primarily constructed for the burial of an adult skeleton, contains portions of at least three skeletons. The only bones not disarticulated were those below the pelvis of one of the skeletons and these were on the bottom of the grave. The right femur was slightly burned. Directly above and in contact with this portion of the skeleton was a mass of burnt and unburnt bones of two other skeletons and the upper bones (burnt and unburnt) of the first skeleton. Many of these bones were broken. The mixed earth in contact with these bones and extending to the surface of the hard-pan was burnt, although the bottom of the grave shows but little action of fire. Of the bones in the lower end of the grave some were burnt, while others in contact with them were unburnt. In this grave were found two pieces of worked antler and thirteen pieces of copper.

Grave 32 of Mr. Merwin's Trench E.

Adult; that portion of the skeleton above the pelvis was in cache-pit 26, and the portion from the distal ends of the femora down was in cache-pit 25. Those portions in the pits had settled to a lower level than the remainder of the skeleton. Along the inside of the right ulna and radius, resting partially on the right pelvic bone, and at the left of the lower jaw, were the skulls of some species of long-billed birds. Between the pelvic bones were two bird bones; on the breast had evidently been placed a bone with a series of perforations.

Total Number of Burials. The following is a summary of the total number of burials exhumed by the principal excavators and recorded in the field notes deposited in the Peabody Museum.

NUMBER OF BURIALS					
C. L. Metz	1879	360	J. R. Swanton	1897	230
" " "	1880	239	R. E. Merwin	1907	85
" " "	1881	58	" " "	1908	176
F. W. Putnam	1882	6	B. W. Merwin	1911	82
					<hr/>
					Total 1236

To the above total should be added a number of burials sufficient to account for those washed out prior to the discovery of the cemetery, and for those discovered by Dr. Metz in sporadic excavations subsequent to August 13, 1881, at which date the field entries stop. We know that when Professor Putnam arrived in Madisonville on May 2, 1882, Dr. Metz was excavating Block 22, whereas his field notes for the preceding year cease during, or at the end of, the excavations of Block 17. Blocks 2-17 inclusive averaged about 18 burials to the block. As the burials were fewer in the portion of the cemetery explored during the latter part of the excavations, it is probable that an allowance of 12 burials to the block, for Blocks 18-22, would be sufficient. This would bring the total up to 1296 and allowing for burials destroyed or undiscovered it is probable that the total number of burials made in the cemetery was not less than 1350.

Death Rate as Indicated by Burials. In order to calculate the population of the village site to which the cemetery belonged we should know the total number of burials, the length of time during which the cemetery was used, and the average death rate per annum.

There exists very little reliable data concerning the death rate of modern primitive peoples. However, the following method of approximation seems legitimate in this instance. The proportions of different ages in the burials of the cemetery will be compared with the mortality statistics for different ages in various European countries. If we find the constituent age proportions agreeing closely with those of some European country of which the average annual death rate is known, it may reasonably be concluded that the annual death rates are also approximately the same.

Fortunately, Dr. Metz carefully recorded the approximate age in the case of more than five-sixths of the burials he found.

SEX AND AGE

Year	Adult Sex undeter.	Adult Male	Adult Female	Adol. Age 18-11	Child. 10-3	Infants	
1879.....	114	21	10	8	75	3	
1880.....	25	59	53	10	56	30	
1881.....	10	15	12	1	10	9	
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	
	149	95	75	19	141	42	Total 521
Per cent.....	28.6	18.2	14.4	3.7	27.1	8.1	100.00

In this connection the following table will be instructive.

AGE AT DEATH

Place	Year	Age 0-10	10-20	20+	Year	Aver. Annual Death Rate
Italy.....	1872-77	52.37	4.22	43.41	1865-78	2.99
France.....	1866-77	32.28	4.25	63.47	1865-77	2.46
England.....	1860-70	44.23	4.56	51.21	1865-78	2.20
Prussia.....	1875-77	52.43	3.51	44.06	1865-78	2.72
Bavaria.....	1871-77	52.61	2.22	45.17	1865-78	3.09
Austria.....	1865-77	52.38	4.05	43.57	1865-78	3.18
Spain.....	1865-70	51.86	4.37	43.77	1865-70	3.12
Russia.....	1870-74	62.33	4.13	33.54	1865-75	3.67
Switzerland..	1873-77	36.94	3.72	59.33	1870-78	2.38
Madisonville..		35.2	3.7	61.1		

In the above table it should be observed that the average annual death rate in the various European countries seems to be correlated closely with the number of deaths per hundred under the age of ten years. Thus, France, with a low percentage of infant and child mortality, has a very low average annual death rate; and Russia, with a very high infant and child mortality, has the

highest annual death rate. In this table the average annual death rate seems to vary more or less directly with the child and infant mortality, except in the case of England, which shows a somewhat lower death rate than would be expected from the number of deaths per hundred under the age of 10 years. This may be due to the fact that the average annual death rate given for England includes Wales, whereas the percentage of ages per hundred does not; or that the period, during which the calculation of the annual death rate is made, is different from the period of calculation of the ages at death per hundred. On the whole, it appears legitimate to infer the approximate annual death rate from the distribution of ages at death per hundred deaths.

Next it appears that the distribution of ages at death in percentage of entire number of burials recorded in Dr. Metz's sample of the Madisonville cemetery agrees most closely with the distribution of ages at death per hundred in Switzerland. The Madisonville cemetery shows a mortality per hundred under 10 years of 35.2 against 36.94 in Switzerland; from ages of 10-20 years 3.7 against 3.72 in Switzerland; over 20 years, 61.1 in Madisonville against 59.33 in Switzerland. The average annual death rate in Switzerland was 2.38 per hundred. We might, therefore, conclude that the death rate per annum in the Madisonville cemetery would be approximately the same.

On the basis of Dr. Metz's sample of 521 burials — almost one half of the total burials recorded in the cemetery — the child and infant mortality is lower than in any of the European countries except France during the period recorded. In selecting data from European countries, I have purposely chosen a period some years back, before the recent improvements in sanitation and medical science brought about the modern lowering of the death rate. Conditions in Europe at that time more closely approximated the primitive, and are, therefore, more comparable with the conditions of health in an aboriginal American cemetery.

It might be argued that we ought to expect a higher annual death rate in a village of Indians, presumably engaged from time to time in warfare, and living under very primitive conditions; but primitive warfare is not deadly, and it is probable that the number of deaths due to war in pre-Columbian America north of Mexico was proportionately smaller than in Europe at most

periods of history. Epidemics also were probably lacking in the New World before the coming of the Europeans.

We may therefore consider 2.3 per hundred as a reasonable approximation for the average annual death rate during the period in which the Madisonville cemetery was used, and if we base our calculations on an average annual death rate of 3 per hundred, we shall be making ample allowance for infant burials overlooked or unrecorded.

Population, and Period of Use of Cemetery. We must next consider the question of the length of time during which this cemetery was used by the Indians. This problem may be approached in two ways — through the historical evidence, and through the evidence of the burials themselves.

The territory at the mouth of the Little Miami River was first colonized in 1788, by a party of 18 persons led by Major Benjamin Stites, within the limits of a tract of 10,000 acres purchased by Major Stites from Judge Symmes. Major Stites constructed a log fort and laid out the town of Columbia.¹

At the time that Major Stites first settled here there was in all probability no village on the Madisonville site. Cyrus Thomas states that Ohio was not inhabited at the time when it first became known to Europeans.² Colonel M. F. Force says:³

In the latter half of the Seventeenth Century, after the destruction of the Eries by the Five Nations in 1656, what is now the State of Ohio, was uninhabited.

The earlier occupants of this region around the mouth of the Little Miami River seem to have been, according to tradition, the Shawnee. The original home and subsequent migrations of this powerful tribe have been a subject that has aroused considerable controversy, into which we shall not enter at this time. It can only be remarked that if we assume the Madisonville Indian village to have been inhabited in the post-Columbian period (and the archaeological evidence supporting this assumption is irrefutable), the following considerations point toward the Shawnee as its probable occupants.

¹ J. R. Dodge, *Red Men of the Ohio Valley*, Springfield, 1860, p. 372.

² Cyrus Thomas, *Indians in Historic Times*, History of North America, vol. ii, 1903, p. 261 et seq.

³ Cf. Col. M. F. Force, *Some Early Notices of the Indians of Ohio*, p. 238.

The western Shawnee of the Cumberland basin are first mentioned in the Jesuit relations of 1648 under the name of Ouch-aouanag. In 1670, as Chaouanoan, they are described as living some distance southeast of their neighbours, the Illinois. Dodge says of them:¹

At the period of the settlement of Virginia, they were doubtless the occupants of what is now the state of Kentucky, from the Ohio River up to the Cumberland Basin, to the country of the Cherokees. The main body, by invitation of the Andastes and Miamis, crossing the Ohio assisted in conflicts with the Five Nations.

They are supposed to have shared the defeat of the Andastes and about the year 1672 fled to escape destruction.

Early in the Eighteenth Century, the Shawnee, as a result of a war with the Cherokee and Chickasaw in the Cumberland region, again moved into Ohio. According to Dodge, when West Virginia began to be civilized they occupied the Scioto Valley and extended as far west as the Little Miami and Mad Rivers, having been invited thither by the Wyandot, at the instigation of the French.

When the region about the mouth of the Little Miami River was colonized in 1788, the Shawnee were still in the vicinity, according to a quotation from Judge Burnet's note by Dodge:²

During these transactions the Judge was visited by a number of Indians from a camp in the neighbourhood of Stite's settlement. One of them, a Shawnee chief, had many complaints to make of the frauds practised on them by the white traders.

The archaeological evidence as to contact with Europeans, yielded by the burials in the cemetery, seems to indicate that the inhabitants were influenced by white culture to a very slight degree, only at the close of the period during which the site was inhabited. A few glass beads and a few bits of iron and brass in the most recent portion of the cemetery are the only traces of European contact.

Traders began to filter through this region about 1750. The inhabitants of the Madisonville site may have been an outlying group of the Shawnee of the Cumberland region who were expelled from Ohio about 1705-15. There is further the possibility that this was a Shawnee village, the occupation of which termi-

¹ *Op. cit.*, p. 22 et seq.

² *Op. cit.*, p. 374.

nated at the time when the tribe was first driven southward out of Ohio after the defeat by the Five Nations in 1672. It scarcely seems probable that this cemetery could have belonged to a Shawnee village of the subsequent migration northward, which took place about 1750, since the site was apparently occupied intermittently for generations, and there is not sufficient time between 1750 and the period of European colonization of the Little Miami Valley to permit the growth of such a necropolis. Further, it seems that a Shawnee settlement subsequent to 1750 ought to show more traces of European contact than are exhibited here. Moreover we are informed that the Shawnee were entirely nomadic bands at the time of the first coming of the traders, but the archaeological evidence points to a sedentary population for this site. Finally, if we are to trust the historical tradition, Ohio was uninhabited in the latter part of the Seventeenth Century.

It should be understood quite clearly that the only reason for connecting this cemetery with the Shawnee tribe lies in the fact that the historical traditions mention no other tribe as occupying this general region during the probable period of the occupation of the Madisonville village and cemetery site. As we know practically nothing of the archaeology and physical anthropology of the Shawnee, it is impossible either to verify this tradition or to refute it. It is equally possible that the site under consideration may have been inhabited by some other tribe concerning which local historical records are silent.

If we assume that Madisonville was a Shawnee site, there are then two possibilities as to the period of its occupation. Either it was occupied up to about the middle of the Eighteenth Century or for a period anterior to 1672. The latter seems the more probable.

A priori it seems unlikely that, considering the movements of tribes in early post-Columbian times, any Indian village in this region would be occupied continuously for more than one hundred years. But the Madisonville cemetery must have been used for a very long time, since a considerable change in burial customs took place within the period of its utilization. Contracted burials and burials in the sitting posture were found only in the oldest portion of the cemetery — the extreme southwestern portion. There are a number of mounds in the vicinity of the cemetery and these

almost certainly antedate the necropolis, although it cannot be stated with certainty that the same Indian group was responsible for both forms of burial. In the more recent portion of the cemetery the majority of skeletons were buried unaccompanied by artifacts and there are occasional finds of objects indicating European contact.

But the strongest evidence of a long continued use of the cemetery seems to be afforded by the very large number of burials that have been disturbed in order to make room for later interments. Not only were there found frequent instances in which one body was laid in a grave over some portion of an earlier grave, but even more commonly an old grave was cleared out and its contents deposited in a heap in a corner of the new grave or nearby. Some of these "bunched" burials may be the remains of those who died away from home and whose bones were subsequently interred in the local cemetery, but in most instances they are probably due to the necessity of finding room in the sacred burying ground, which brought about the disturbance of the earlier burials by the late dwellers on the site.

Now it seems very improbable that people who buried their dead with the comparatively elaborate funeral furniture which is found in many of the earlier graves in this cemetery, would be likely to desecrate the graves of their ancestors within the time when the identity of the individuals who occupied the various graves could be remembered. In other words a man would be loathe to disturb the remains of his great-grandfather, as long as he knew where that ancestor was buried. Allowing twenty years to a generation it is probable that the fifth generation would have been entered upon before all the members of the first were dead and their burial places forgotten. If this argument is valid, it would then seem that the minimum period which could be considered to have elapsed between the first burials in the cemetery and the subsequent ones, to make room for which the former were dislodged, must have been between eighty and one hundred years.

But, as has been stated above, it seems improbable that any Indian group during this general period of tribal movements would have occupied the same site continuously for much more than one hundred years. Therefore, we may accept one hundred years as the approximate length of time during which the Madison-

ville village site was inhabited. This may perhaps be considered a minimum estimate. Assuming the total number of burials in the cemetery to have been about 1350 and the annual death rate to have been about 3 per hundred, a village of 450 to 500 inhabitants would have been sufficient to fill this cemetery in a century.

We may be able to secure some check on this estimate of the size of the village by considering the house remains on the site adjoining the cemetery. In 1879 Dr. Metz excavated four hut circles, and in 1882 Professor Putnam excavated four more. Those excavated by Professor Putnam varied in diameter from 40 to 60 feet. It is therefore evident that there were at least eight communal houses in the village, although these may not all have been contemporaneous. Each of these communal houses must have been the home of grandparents, parents, and children, averaging forty to fifty individuals to the house. Taking the lower figure, we should have a total of 320 inhabitants for the 8 houses, if they were occupied at the same time. But it is pretty clear that Professor Putnam and Dr. Metz did not excavate all of the hut circles on the site. There were at least four others in the group northeast of the cemetery. Twelve such houses should contain 450 to 500 inhabitants.

This group of hut circles to the northeast would probably represent the location of the latest village on the site. The sites of the earlier houses are indicated by the hearths found from time to time by the excavators in the various portions of the cemetery. The original settlement probably was on the southwestern corner of the plateau. The dead were buried about the houses, and as rubbish and graves accumulated, the house sites gradually moved northeastward.

It thus appears that this cemetery was probably the burying place of a village from 450 to 500 in population for a period of about a century.

THE CACHE-PITS

Discovery. The cache-pits, called "ash-pits" by Dr. Metz and the other excavators after him, are scarcely inferior in interest and importance to the burials. The first of these was explored by Dr. Metz on April 1, 1879. The first cache-pit to be described fully was dug on April 22 of the same year. Of it Dr. Metz says in his field notes:

An ash-pit was excavated to a depth of $4\frac{1}{2}$ feet and a diameter of $3\frac{1}{2}$ feet. The sides and bottom showed no evidence of the action of fire. It appears that the pits had been dug and the ashes put in them *as ashes* to a depth of $2\frac{1}{2}$ feet . . . In it were numerous bone implements, shells, and animal remains, none of which bare any traces of the action of fire. A few fragments of charred bones that had probably been in the ashes previous to their deposition here were also found.

Hereafter, Dr. Metz carefully explored every cache-pit encountered, noting, in most cases, the depth, diameter, stratification of contents, and character of associated objects.

Number and Depth of Cache-pits. The following table gives the totals of pits recorded by the excavators in their field notes that are in the possession of the Museum.

NUMBER OF CACHE-PITS					
C. L. Metz,	1879-81	429	J. R. Swanton	1897	177
" " "	1882	12	R. E. Merwin,	1907-08	247
F. W. Putnam,	1882	7	B. W. Merwin,	1911	118
					Total 990

In order to give an accurate idea of the main dimensions of these pits, the data in regard to those excavated by Dr. Metz in 1879 have been tabulated. By far the majority were round or oval in shape. The few oblong ones have been omitted from consideration in the following tables.

DIAMETER OF CACHE-PITS							
	Less than 2 ft.	2 ft.	2 ft. 6 in.	3 ft.	3 ft. 6 in.	4 ft.	4 ft. 6 in. and over
Number. . . .	1	6	19	70	36	13	2
Per cent. . . .	.7	4.1	13.0	47.6	24.5	8.8	1.4
							Total 147
							Mode 3 ft.

DEPTH OF CACHE-PITS			DEPTH OF ASHES		
Depth	Number	Per cent	Depth	Number	Per cent
2 ft. 6 in.-2 ft. 11 in.	1	.7	1 ft.-1 ft. 5 in.	9	7.9
3 ft.-3 ft. 5 in.	16	10.8	1 ft. 6 in.-1 ft. 11 in.	20	17.7
3 ft. 6 in.-3 ft. 11 in.	12	8.1	2 ft.-2 ft. 5 in.	24	21.1
4 ft.-4 ft. 5 in.	22	14.9	2 ft. 6 in.-2 ft. 11 in.	18	15.9
4 ft. 6 in.-4 ft. 11 in.	14	9.4	3 ft.-3 ft. 5 in.	22	19.1
5 ft.-5 ft. 5 in.	32	21.6	3 ft. 6 in.-3 ft. 11 in.	9	7.9
5 ft. 6 in.-5 ft. 11 in.	27	18.2	4 ft.-4 ft. 5 in.	5	4.4
6 ft.-6 ft. 11 in.	22	14.9	4 ft. 6 in.-4 ft. 11 in.	4	3.9
7 ft.	2	1.4	5 ft.	2	1.7
Total.	148		Total.	113	

It will be observed from the above table that almost three-fourths of the pits were between 3 feet and $3\frac{1}{2}$ feet in diameter; that the depths varied greatly but were in the majority of cases from $4\frac{1}{2}$ feet to 6 feet; that the depth of ashes was usually from $1\frac{1}{2}$ feet to $3\frac{1}{2}$ feet.

Contents and Stratification. Some of the pits were stratified and some were not. In order to give a clear idea of the stratification and contents of typical pits descriptions have been copied from Dr. Metz's notes.

Cache-pit 396

Depth 5 ft. 3 in.; diameter 3 ft. 3 in.

10 inches leaf mould

28 inches sand and gravel

25 inches ashes

Contents: animal remains, shells, sherds, burned limestone, flint and bone relics.

Cache-pit 400

Depth 5 ft. 10 in.; diameter 3 ft. 2 in.

10 inches leaf mould

12 inches sand

48 inches ashes

Contents: burned limestone, animal remains, flints, sherds, shells, one piece of copper.

Cache-pit 401

Depth 6 ft. 8 in.; diameter 3 ft. 3 in.

10 inches leaf mould

24 inches sand

46 inches ashes

Contents: animal remains, burned limestone, shells, perforated unios, a large quantity of deer skulls, awls, cylinders.

Cache-pit 402

Depth 5 ft. 6 in.; diameter 3 ft. 2 in.

10 inches leaf mould

5 inches sand

19 inches yellow sand and ashes

3 inches yellow sand

19 inches sand and ashes

4 inches sand

6 inches ashes

6 inches ashes in depression in middle of bottom

Contents: animal remains, burned limestone, large sherds of pottery, shells, elkhorn implement, awls, flints, record stick.

Cache-pit 404

Depth 4 ft. 1 in.; diameter 4 ft.

10 inches leaf mould

40 inches ashes

Contents: two bushels of snail shells.

Cache-pit 409

Depth 5 ft. 2 in.; diameter 3 ft. 10 in.

10 inches leaf mould

30 inches sand

22 inches ashes

Contents: animal remains and fish hook.

Cache-pit 411

Depth 5 ft. 6 in.; diameter 4 ft.

10 inches leaf mould

32 inches sand

3 inches yellow sand

10 inches sand and ashes

11 inches ashes

6 inches of ashes in depression in bottom

Contents: animal remains, a stone pipe, and an elkhorn implement.

The following cache-pits are less typical but present features of special interest:

Extract from Dr. Metz's notes, August 27, 1879:

One of the most remarkable "finds" since the prosecution of the work on this cemetery was a large quantity (4 or 5 bushels) of burnt corn, in a pit which was opened and explored August 26 and 27. The shape of the pit was oblong and contracted toward the center, a horizontal section showing somewhat like a figure 8. Its dimensions were: length 6 ft. 8 in.; diameter 3 feet at each end; total depth 6 ft. 3 in.

Beginning at the bottom the contents were as follows:

- (1) A layer of bowlders, pottery sherds, ashes, with a few animal bones, about 6 inches in thickness.
- (2) Above this a layer of completely carbonized corn on the cob.
- (3) Matting, composed of twigs and coarse grasses — two inches.
- (4) Then about 4 bushels of shelled corn, also completely carbonized. The corn and floor of bowlders occupied one half of the pit or one loop of the figure 8, its superficial area being a circle of about three feet in diameter, its depth 10 inches.
- (5) Above the corn was a layer of coarsely woven matting composed of grass, cornstalks and twigs, also completely charred, depth 4 inches.
- (6) Next came a layer of ashes 10 inches in thickness, intermingled with which were bones of deer, elk, bear, racoon, opossum, turkey, mink, woodchuck, squirrel, and beaver, together with unio shells of various species.

- (7) Fifteen inches of gravelly clay also containing numerous animal remains with occasional implements of flint, bone and stone, and unfinished stone pipe representing a bear sitting on his haunches, and sherds of pottery.
- (8) Two feet of black leaf mould.

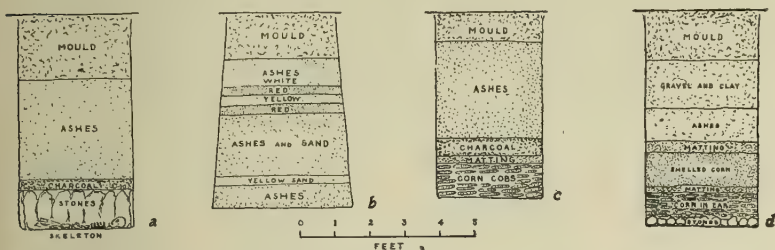


FIG. 1. MADISONVILLE SITE

Cross-sections of abandoned and filled cache-pits from Dr. Metz's note-books; *a*, Cache-pit used for burial purposes, opened January 21, 1880; *b*, Pit opened August 8, 1881; *c*, Pit opened in May, 1881; *d*, Pit opened August 26-27, 1879. Aside from the materials shown in the cross-sections, the pits contained potsherds, bones of various animals, implements and other objects of stone, bone and antler.

It is quite obvious that this peculiar shaped pit was really two intersecting and independent round pits, one of which had been used for a corn cache; a cross-section of this is given in figure 1, *d*.

Cache-pit 377

- Depth 5 ft. 8 in.; diameter 3 ft.
- 10 inches leaf mould
- 36 inches ashes containing animal remains
- 6 inches charcoal and animal remains
- 4 inches matting
- 12 inches corn cobs

Contents: "At a depth of 4 ft. 4 in. a layer of charred animal remains was found and below this a layer of matting 4 inches deep, and below this matting carbonized corn cobs. On the matting a layer of plaited grass rope was found [figure 1, *c*].

Mr. Swanton found a layer of corn cobs in the bottom of pit I, 33, and small quantities of corn in other pits.

A layer of corn 2 inches thick and 4 feet from the surface was found in cache-pit II, 23. Two feet, 8 inches from the surface of the hard-pan was a concreted mass of gravel discolored by fire and about 9 inches thick. The mass seems to have become solidified under the influence of a hot fire though whether this fire occurred before the concretion was thrown into the cache-pit or subsequently could not be determined.

Fauna Represented in the Cache-pits. The following is a quotation from Mr. Swanton's report:

By studying the contents of over one hundred cache-pits, twenty-one species of animals were identified, one species of bird, two of turtles, and two of fish. These are deer, bear, dog, elk, buffalo, racoon, opossum, beaver, porcupine, woodchuck, lynx, fox, puma, wolf, otter, squirrel, skunk, mole, rabbit, marten, badger, turkey, leather-back turtle, turtle, catfish and perch (?). Deer bones overbalanced all others in the proportion of at least three to one. Few badger, squirrel, skunk, wolf, puma, and rabbit bones were

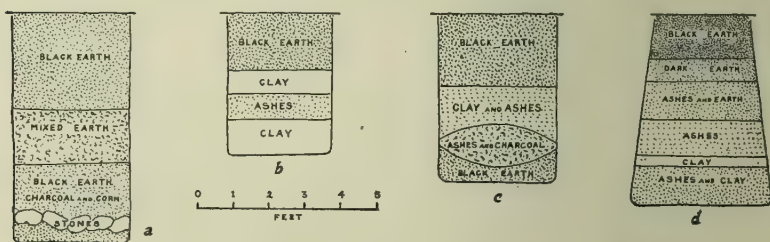


FIG. 2. MADISONVILLE SITE

Cross-sections of abandoned and filled cache-pits from Mr. Swanton's note-books; a, Pit 6, Trench IV; b, Pit 54, Trench I; c, Pit 15, Trench II; d, Pit 64, Trench I.

found. In the case of the rabbit this is very remarkable since rabbits are very plentiful in the region.

Of the mole and marten only one skull each was found, the latter associated with a burial; of the otter only two skulls, also associated with burials, and a fragment of a third were found.

Below is an analysis of two pits showing approximately the proportion of bones belonging to each species which they contained.

Cache-pit III, 6

Deer	80	per cent
Turkey	8	"
Bear	2.5	"
Elk	2.5	"
Dog	2.5	"
Turtle (2 species)	2.5	"
Racoon	0.5	"
Beaver	0.5	"
Opossum, puma, fish, fox, otter, wood- chuck, badger	1.0	"
Total	100.00	"

Cache-pit III, 8

Deer	75	per cent
Dog	7.5	"
Elk	7.5	"
Bear	5.0	"
Beaver, racoon, tur- key, turtle, fish	5.0	"
Total	100.00	"

The finding of the skulls of the marten and otter with burials without other bones of these animals indicates that they formed portions of medicine bags made of the whole skin of these animals with skull attached.

Similar bags of otter skin were used in the well-known Shell Society and the presence of these skulls seems to indicate that this ceremony was known to these Indians.

The shells found belonged principally to the genus *Unio*. Most of the species having smooth shells could not be identified, but of the following there can be no doubt: *Unio rectus* (Lamareck), *vermicosus*, *tuberculatus*, *ovatus*, *undulatus*, *cornutus* (Barnes), *alatus* (Say), *Margitana rugosa* (Barnes). One small species of the uni-

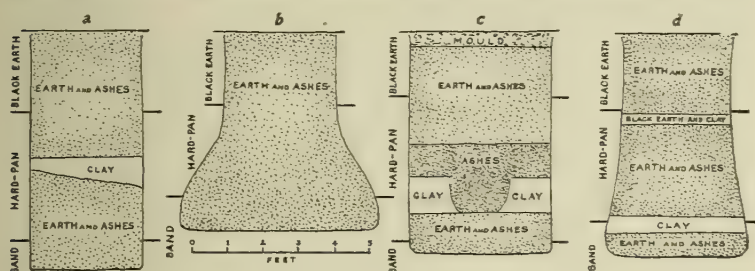


FIG. 3. MADISONVILLE SITE

Cross-sections of abandoned and filled cache-pits in Trench D, from R. E. Merwin's notebooks. Mr. Merwin's cross-sections were the first to show that probably most of the pits were dug through a stratum of hard-pan, and into the substratum of sand which afforded excellent drainage and served to keep the contents of the caches dry.

valve (*Fulgur carica*) was found in addition to a small sea uni-valve *Marginella apicina*. The latter species is found on the Gulf Coast and the shores of the Carolinas.

Artifacts from the Cache-pits. The following extracts from the notes of Mr. B. W. Merwin give a sufficient idea of the number and character of artifacts found in typical cache-pits.

Cache-pit 51, Trench H

Depth of leaf mould, 8 in.

Depth to hard-pan, 1 ft. 8 in.

Depth to bottom, 5 ft. 2 in.

Diameter at hard-pan, 3 ft. 8 in.

Specimens: 1 bone scraper, 3 antler cylinders, 1 antler point, 2 worked antlers, 1 fragment bone scraper, 1 notched rib, 1 celt, 1 fragment celt, 1 perforated shell, 1 flint point, 1 flint scraper, 2 worked stones, 100 bones, 75 unworked stones, 40 shells, 25 flint flakes, 40 potsherds.

Cache-pit 7, Trench K

Depth of leaf mould, 5 in.
Depth to hard-pan, 1 ft. 1 in.
Depth to bottom, 4 ft. 8 in.
Diameter at hard-pan, 3 ft. 2 in.

Specimens: 1 worked beaver tooth, 1 bone bead, 1 long bone perforator, 1 fragment bone scraper, 1 perforated shell, 1 small whetstone, 1 perforated bone, 150 unworked bones, 30 stones, 25 shells, 30 potsherds, 15 flint flakes.

Cache-pit 10, Trench H

Depth of leaf mould, 9 in.
Depth to hard-pan, 1 ft. 9 in.
Depth to bottom, 3 ft. 7 in.
Diameter at hard-pan, 2 ft. 8 in.

Specimens: 2 antler cylinders, 2 fragments bone scrapers, 1 bone perforator, 5 flint points, 8 reject flint points, 1 worked bone, 1 fragment pipe, 2 rough hammerstones, 1 grinder, fragments of bones of two kinds of dog, 100 stones, 175 bones, 50 potsherds, 40 flint flakes, 30 shells, 4 quarts charred wood.

Pit filled with black earth and clay with a 5 inch layer of bones and ashes about 2 ft. 9 in. from the surface.

Occasionally pieces of copper or ornaments of copper were found in the pits. These finds were more common in the portion of the cemetery excavated by Dr. Metz. Beads were the commonest objects of copper found by Mr. Swanton in the pits. From pit I, 50, were recovered three copper discs made by clinching thin pieces of copper over bone. In pit I, 55, was a small copper ornament 4 inches long, in shape of a serpent.

Iron was of very infrequent occurrence in cache-pits. On September 19, 1879, Dr. Metz found a piece of an iron hatchet or tomahawk, 13 inches below the surface in the leaf mould between two cache-pits. Mr. Swanton found a flat piece 2 inches long by $1\frac{1}{2}$ inches wide in the first pit he opened. This was 3 feet 1 inch below the surface and at least 1 foot below the level of the hard-pan. In pit I, 66, another piece was encountered at a depth of 3 feet below the level of the hard-pan and $4\frac{1}{2}$ feet from the surface.

R. E. Merwin found an iron ring in pit 98, Trench D. The ring was 27 inches below the surface of the ground, the leaf mould being 4 inches in depth. There was no evidence of its intrusive origin as there was no root hole above it. Skeleton 65 was buried with its head in the cache-pit on the level with the ring, but the ring was 21 inches from the skull.

B. W. Merwin found a piece of iron in pit 27, Trench I. This was a perforated piece of iron, little oxidized. It came from a depth of one foot eight inches, the soil above it being black earth mixed with potsherds and shells. Merwin thought that it must have worked down a root hole, as there was a root hole 5 inches away, about 3 inches in diameter.

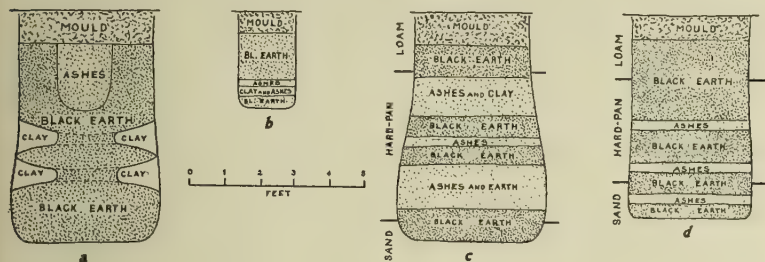


FIG. 4. MADISONVILLE SITE

Cross-section of abandoned and filled cache-pits from B. W. Merwin's note-books; a, Pit 3, Trench G; b, Pit 24a, Trench H; c, Pit 30a, Trench I; d, Pit 26, Trench I. In common with nearly all pits of this site, potsherds, various implements and the bones of animals were found in the refuse with which they were filled.

Mr. Swanton found fragments of blue glass beads in three cache-pits (I, 44; I, 64; IV, 31). Mr. B. W. Merwin also found a blue glass bead in one of the pits that he excavated.

Form of the Cache-pits. The great majority of the pits were round or oval in shape, but Dr. Metz discovered some that were oblong. He records about ten of these. The first of this shape, opened May 19, 1879, was 3 ft. 2 in. in depth, 7 ft. 3 in. long, and 4 ft. 6 in. wide. It contained 16 inches of ashes. The following is his description of one of the oblong pits:

October 17, 1879

Large oblong cache-pit. Depth 4 ft. 3 in., length 8 ft., width 6 ft. 5 in.

Contents: leaf mould 10 in.

Ashes and sand 10 in.

Pure ashes 15 in.

Sand 6 in.

Ashes, charcoal, and bowlders, 10 in.

Specimens: one grooved stone hammer, one elkhorn implement, one large piece of elkhorn, broken bowlders, potsherds, bear cranium, flints.

It will be observed that the contents of the oblong pits are not different in character from the round ones. Apparently the later investigators did not find any of these oblong pits.

The circular and oval cache-pits occasionally had a larger diameter at the bottom than at the top and often the reverse. Bottle-shaped cache-pits also occurred.

Grouping in Relation to Burials. The cache-pits were often found in groups, as may be seen from the plan of the cemetery (plate 30). Sometimes two or more pits were dug so close together that their sides intersected.

Generally speaking the site was divided into portions rich in cache-pits and with very few burials on the one hand, and parts with many burials and few pits on the other. It seems that for the most part the pits are not connected with the burials except fortuitously. In a few instances, which have been dealt with under the consideration of the burials, bodies were buried in the cache-pits, simply because the empty pit offered a convenient ready-made grave. In other cases bodies were buried over these pits, or cache-pits were dug through burials. Yet there is nothing that points to any special relationship between the graves and the pits.

On the other hand there is no doubt at all that the graves and the pits were made by one and the same people during the same period. The identity of artifacts in the pits with those found in the graves establishes this fact beyond question.

Purpose of the Cache-pits. The earlier excavators seem to have considered the existence of this large number of pits, laboriously dug down through the hard-pan, as more or less of a mystery. Yet there is no evidence of their having subserved any obscure esoteric purpose. On the contrary it seems that they were dug for a very practical end.

All of the investigators note that for the most part the bottoms and walls of the pits show no trace of the action of fire, but that the ashes and other charred debris seem to have been dumped into the pits after having been subjected to the action of fire. In a few instances fires seem to have been made in partially filled pits, or burning embers were emptied into the pits.

In the opinion of the present writer the cache-pits were constructed primarily for the storage of corn and other goods. At

the harvest time the maize crop belonging to each family was deposited in a number of pits grouped together and located conveniently near the house-site or place of habitation. Indeed these pits may often have been within the houses or huts. In the course of the winter the pits were emptied one after another and the empty pits became successively the receptacles into which were swept the accumulating ashes, food remains, and other debris of the hearth and home. When a pit showed stratification of contents it was because it was filled with rubbish gradually, and when the contents were unstratified it was due to the dumping of a large amount of refuse into the pit at one time. Some of the stratified pits were probably left partially filled for a considerable length of time; fires were occasionally made in them, and in a few instances the empty or partially filled pits were utilized as graves.

Ample indication that the pits were used as granaries is afforded by the two pits described above, in which Dr. Metz found charred shelled corn and charred corn on the cob covered with matting (figure 1, c, d).

Historical evidence confirms the conclusion that the pits were granaries. Wood says in speaking of the customs of the New England Indians: ¹

Their corne being ripe, they gathered it, and drying it hard in the Sunne, conveyed it to their barnes, which be great holes digged in the ground in the form of a brass pot, seeled with rinds of trees, wherein they put their corne.

Morgan also states the following in regard to the corn pits of the Iroquois: ²

The Iroquois were accustomed to bury their surplus corn, and also their charred green corn, in caches in which the former would preserve uninjured throughout the year, and the latter for a much longer period. They excavated a pit, made a bark bottom and sides, and having deposited their corn within it, a bark roof, water-tight, was constructed over it, and the whole covered up with earth. Pits of charred corn are still found near their ancient settlements. Cured venison and other meats were buried in the same manner, except that the bark repository was lined with deer-skins.

The above also explains the reason for the carbonized condition of the corn found in the pits by Dr. Metz.

¹ William Wood, *New England's Prospect*, p. 100.

² L. H. Morgan, *League of the Iroquois*, p. 319.

Additional evidence is furnished by Catlin, who, in speaking of the Mandan Indians says:¹

The green corn season is one of great festivity with them, and one of much importance. The greater part of their crop is eaten during these festivals, and the remainder is gathered and dried on the cob, before it has ripened, and packed away in "caches" (as the French call them), holes in the ground, some six or seven feet deep, the insides of which are somewhat in the form of a jug, and tightly closed at the top. The corn, and even dried meat and pemmican, are placed in these caches, being packed tight around the sides, with prairie grass, and effectually preserved through the severest winters.

Alice C. Fletcher, also, in speaking of the expeditions of the Omahas, says:²

If any were so fortunate as to possess a surplus supply of food or clothing, they would store it in a cache, which they might either conceal or leave undisguised. The cache was dug in a dry place, sometimes lined with poles, but often left with no wall but the hard soil. The goods were covered with skins, the earth was thrown over, and the place marked with piles of stones — meat, corn, clothing, and other personal property were kept for months in this manner, and no one disturbed the hidden store.

That caches of this character were used by the Indians over a very wide area in North America is shown by their existence among the Thompson Indians of British Columbia. In regard to their methods of storing food, James Teit says:³

The most common cache is the Indian cellar. This is used solely for the storing of berries, fish, etc. A circular hole about four feet in depth, and of the necessary diameter, is dug. In it are carefully laid the articles to be stored. If these are berries or roots, they are placed in baskets, and wrapped over with birch bark. The roof is then put on. It consists of small poles laid closely side by side across the excavation. Above them are laid in the same manner, but at right angles, another row of poles. The structure is then covered with pine needles and earth.

H. I. Smith states that pits which are supposed to be the remains of the cellars are found near the ancient underground house-sites in the Thompson River region.⁴

In the mound region in general, archaeological confirmation of the identity of the "ash-pits" with caches mentioned by the historians is not lacking.

¹ Geo. Catlin, *North American Indians*, vol. i, p. 121 et seq.

² Alice C. Fletcher, *Tribal Life Among the Omahas*, Century Magazine, January, 1896, p. 450.

³ James Teit, *The Thompson Indians of British Columbia*, p. 198 et seq.

⁴ H. I. Smith, *Memoirs American Museum Natural History*, vol. ii, no. 6, p. 403.

Speaking of the enclosures in New York, Squier says:¹

The first feature which attracts notice upon entering them is a number of pits or excavations in the earth, usually at points which are most elevated and dry. These pits are occasionally of considerable size, and are popularly called "wells," although nothing is more obvious than that they could never have been designed for any such purpose. They are usually 3 to 4, but sometimes from 6 to 8, feet in depth, and of proportionate size at the top. Their purpose became sufficiently evident upon excavation. They were the caches in which the former occupants of these works deposited their stores. Parched corn, now completely carbonized by long exposure, is to be discovered in considerable abundance in many of them. Instances fell under my notice where it has been found untouched to the amount of bushels in these primitive depositories. Traces of the bark and thin slips of wood, by which the deposits were surrounded, are also frequently to be found.

Thomas in his work on Mound Explorations identifies pits of this character with caches.²

Finally Alice C. Fletcher writes of the caches of the Omaha Indians as follows:³

Each family had outside the lodge a cache, and some of the families would have two. These caches would be used sometimes for two or three years, but after a time the posts would become worm-eaten or the rain get in and if the cache was not repaired, as it occasionally was, a new one would be built close beside it and the old one taken for other uses to be described. In the cache was kept the winter supply of corn, dried meat and other provisions and the gala dresses and ornaments of various kinds. These were kept in parfleche packs; also the sacred articles, such as medicine bags, or sacred bowls, etc. When a village was attacked it was always considered important to try and burn the caches. Fire was put in the cache and the articles consumed in the hole; sometimes they were only charred. A malicious person having a grudge would sometimes take revenge by burning a cache.

The old caches were used for ash-pits. The accumulations of ashes in the center fireplace (a circular depression in the center of the lodge) would be cleared, and the ashes thrown in the pit. So also the bones and refuse of eating, and of feasts, and the broken implements and weapons, worn-out moccasins, and other articles. When the pit was filled up it was closed over and another one taken. The sites of the old villages are honeycombed with these caches, the Indians say, and I am invited to examine them if I like, the Indians laughingly heartily at my queer curiosity.

¹ E. G. Squier, *Smithsonian Contributions to Knowledge*, vol. ii, p. 12 et seq.

² Cf. Thomas, *Twelfth Report Bureau American Ethnology*, p. 32 et seq.

³ *Peabody Museum Reports*, vol. iii, pp. 357, 358.

HEARTHES AND OTHER REMAINS

Hearths and Fire Places. J. R. Swanton says in his report:

Hearths are formed by a few stones laid side by side. They were usually a foot to a foot and a half in depth and two to three feet in diameter, though the outline was by no means always circular.

Mr. Swanton excavated thirteen of these hearths or fire places, R. E. Merwin describes four, and B. W. Merwin two. Dr. Metz apparently did not distinguish the hearths from the shallower cache-pits. From the number of burned stones which he, in contrast with the other excavators, describes as found in the cache-pits, it seems clear that the earlier inhabitants of the village often dumped their hearth stones with their ashes into the cache-pits at the end of the season, and that they often used the depressions in the earth, caused by partially filled cache-pits, as hearths.

The following discovery described by Dr. Metz is certainly a hearth:

Monday, March 31, 1879. Under the leaf mould I discovered a circular layer of ashes 4 inches deep and below it were burnt limestones and bowlders. Below these was a layer of mussel shells (unio) 3 inches thick. Below the shells a large round bowlder upon which rested an elliptical flint instrument, 3 inches long. The bowlder rested upon a layer of sand 8 inches deep, and on the clay partially covered by the sand and at a total depth of $2\frac{1}{2}$ feet were two large prongs of elkhorn.

R. E. Merwin describes as follows certain of the hearths explored by him:

Hearth 1, Trench A

Depth of top of rocks below surface of ground, 13 in.

Total depth of depression, 25 in.

Depth of depression below surface of hard-pan, 6 in.

The depression or pit was of irregular shape being 5 ft. 2 in. long, and 3 ft. 9 in. at its widest part. Throughout the pit charred wood was found in great abundance. Within the pit and resting on the hard-pan were arranged irregular pieces of limestone varying in size from 1 inch in diameter to 10 inches, and also a number of pieces of sandstone. These stones showed action of fire as did the floor and walls of the pit. No charred animal bones were found or any artifacts. One potsherd was found above the pile in the loam 5 inches below the surface.

Hearth I, Trench B

Total depth below surface, 2 ft. 7 in.

Depth below surface of hard-pan, 5 in.

Leaf mould, 3 in.

Diameter, $23\frac{1}{2}$ in.

This was a saucer-like depression in the hard-pan. The sides were not burnt. Four inches above hard-pan was a layer of large unburnt rocks, below this a stratum of black earth mixed with ashes. In this were found the fragments of the skull of a bear and a few fragmentary animal bones. Two inches below surface of hard-pan was a layer of burnt clay 1 inch thick, and below it was black earth with a great amount of ashes. All of the following finds in this stratum were burnt: a large potsherd, 6 grains of corn, fragmentary animal bones, and a burnt clay ball.

Mr. Swanton distinguishes between hearths and fire places. The latter he defines as " areas on the surface of the hard-pan where the soil had been reddened by fire."

There was a great variation in the size and shape of these areas. . . . Usually such fire places seemed to bear no definite relation to ash-pits or burials, though there may be an exception in the case of skeleton IV, 27, which lay over a stratum of charcoal covering a layer of red earth, probably a fire place. Ash-pit IV, 10 was surrounded by fire place 23. To the uniformity and apparent absence of importance of these fire places we must except fire places 29, 36, and 37, Trench IV. Fire place 29 from its singular shape and the peculiarity of its contents and surroundings I have ventured to call an altar. It bears some resemblance to the altars found at the Turner Group of mounds higher up the Little Miami River. This altar was a small saucer-like depression in the surface of the hard-pan, baked red by fire and filled with very fine white ashes. Its depth below the surface was 2 ft. 10 in. and its diameter 1 ft. 9 in. The depth of the hollow forming this altar was 7 inches. The head of skeleton IV, 30, lay beside this altar, and ash-pit IV, 26, was a short distance off. Fire place 36 was similar to the others except that it was connected with the altar and unlike other fire places, pieces of a pot or of pots were found imbedded in the discolored soil. This discolored soil was about 2 inches in thickness. Fire place 37 also in all probability had something to do with the altar, but it was not directly connected with it.

The present writer feels that the evidence upon which Mr. Swanton based his opinion that fire place 36 was an " altar " is insufficient.

B. W. Merwin found two of these burnt places in Trench E. It seems probable that these fire places and hearths mark the site of habitations or camp-fires.

Post-holes. Mr. Swanton writes in his report:

Under the general name of "post-holes" I have catalogued many little excavations too small for cache-pits, and of rather doubtful significance. These were usually one to two feet in diameter, by from two to four feet in depth, running one or two feet into the hard-pan. Their contents were very insignificant — a bed of ashes, some charcoal, a few bones, a little charred wood, a few limestone pebbles, and a celt or two being about all that was discovered. The pits containing charred wood may really have been post-holes. No one can tell about the others.

Dr. Metz probably did not distinguish these "post-holes" from cache-pits. Mr. Swanton records about a dozen of them, R. E. Merwin 30, B. W. Merwin 25. They were evidently found for the most part in the northeastern portion of the cemetery, and especially in Trench F and Trench I. The majority of them contained nothing but mixed earth and charred wood. Those reported by R. E. Merwin varied from 6 inches to 11 inches in diameter, averaging about 8 inches, the depths being from $2\frac{1}{2}$ to 3 feet. They are therefore smaller than those reported by Mr. Swanton. Those excavated by B. W. Merwin were of similar dimensions but with a slightly larger range in diameter and depth. Sometimes there were a few bones, potsherds, stones, and ashes in them.

It seems probable that many of these "post-holes" of small diameter, were, as Mr. Swanton suggests, actually what the name implies. Some of the larger ones may have been small cache-pits, but they were usually unstratified.

Kitchen-middens. Dr. Metz discovered two kitchen-middens in the course of his work in the cemetery. The first of these he describes in his notes as follows:

March 20 to April 1, 1880

Work in the kitchen-midden was continued until April 1, and having reached the head of the ravine, it was deemed advisable to abandon further excavations at this point for the present. This deposit of kitchen refuse extended $34\frac{1}{2}$ feet across the head of a ravine on the west side of the plateau, averaging in depth 6 to 7 feet, and was made up of irregular deposits of ashes, charcoal and sand, animal remains, unio shells, and sherds.

This midden also yielded a few burials and cache-pits, and many artifacts. On April 2, a second kitchen-midden was discovered on the eastern edge of the plateau. This is evidently the one subsequently explored by R. E. Merwin in 1907.

Mr. Swanton excavated a kitchen-midden in his portion of the cemetery which occupied a depression running east and west.

The width of this midden was about thirty feet; its length, as far as traced about seventy, though it ran a considerable distance further east. In the deepest place this kitchen-midden measured about four feet, shallowing gradually on each side. The average depth may have been about three feet. The soil composing this kitchen-midden was dark and rich and similar to the forest mould, except that layers of ashes were very common, often extending to the very bottom. A great deal of charcoal was scattered throughout but the proportion of animal bones was comparatively meager. Flints and flint points were common and so many small articles of interest were discovered that it was found advisable to pass all the earth through screens.

The kitchen-midden explored by R. E. Merwin near Trench C had been formed by filling up a small ravine with refuse. He states that it was about 40 feet long, 8 to 12 feet wide, and varied in depth from 3 feet 6 inches to 5 feet. The following is a list of the objects found in this refuse heap:

Human mandible, 1	Antler blades, 9
Human patella, 1	Fragments of bone fish-hooks, 2
Perforated shells, 30	Bone awls, 12
Stone celts, 3.	Bone awls (fragmentary), 12
Stone celts (fragmentary), 2	Notched bone awl, 1
Worked stones, 3	Fragmentary bone scrapers, 48
Sharpening stones, 21	Perforated bone (4 holes), 1
Flint points, 23	Notched bones, 2
Flint knives, 3	Notched antler, 1
Flint scrapers, 4	Grooved hammerstone, 1
Flint rejects, 21	Stone implements, 2
Bone cylinders, 12	Shell object, 1
Bone bead, 1	Piece cannel coal, 1
Worked antler tips, 23	Reject antler points, 2
Worked antlers, 29	

Mr. B. W. Merwin also explored a kitchen-midden in the ravine, running north and south. This midden had the following section:

Leaf mould, 10 in.	Ashes, 4 ft. 3 in.
Black dirt, 1 ft. 10 in.	Black dirt and ashes, 5 ft. 1 in.
Ashes and black dirt, 2 ft. 4 in.	Black dirt and clay, 7 ft. 7 in.
Clay, 3 ft. 2 in.	

Most of the specimens in this midden were found in the ashes at depths varying from 3 feet 2 inches to 4 feet 3 inches.

House Circles. Before the existence of the cemetery on this site was known, Dr. Metz in his survey of the monuments of the region had recorded the existence of a number of circular depressions on the Stites property on the northeastern portion of the plateau. On June 24, 25, 26, four of these circles were investigated by him, by running trenches 3 to 5 feet wide through their centers.

In one of these was found a bed of ashes 20 inches below the surface, containing potsherds, animal remains, and charcoal. Near the edges of the depressions were found an occasional implement or arrowpoint.

When Professor Putnam visited the site in May, 1882, he excavated four more of these circles (plate 30). The following are extracts from his note-book:

May 6, 1882. Circle No. 1

Trench started north and south. Outside to outside of circle 43 feet. At southern end of trench numerous animal bones, burnt limestones, unio shells, and potsherds in the leaf mould. Also a worked antler tip and several flint chips, a rude hoe (?), and on the clay or an inch or two below its surface was a rude grooved axe.

In the center of the circle lying on the clay we came to a layer of stones. Took the stones up and found ashes and charcoal and burnt clay under them. This was a fire place. Leaf mould $1\frac{1}{2}$ feet at north end, 2 feet in center and $2\frac{1}{2}$ feet at south end of trench. At the north end of the ditch were many small burnt stones, a very few animal bones, and a few unio shells. In the central portion were a number of potsherds, clam shells, two broken flints, a broken flat stone with hole (gorget). The central ditch was run to the east. Finished the trenches but found nothing else of importance.

The fire place in the center was on the clay and there is every reason to believe that the floor of the house was hard clay. Now the question is how much of the leaf mould was in existence at the time the house was occupied? The two feet in the center over the fire stones has certainly formed since the house went to decay. How much have the earth worms done here? In digging the trenches very few worms were found, probably not over a dozen or twenty in the whole day's work of three men.

May 8. Circle No. 2 about 60 ft. northwest of No. 1.

Trench runs northeast to southwest. In the center under 6 inches of leaf mould was a bed of ashes 4 inches deep, about 5 feet in diameter. Ashes were fresh and comparatively recent. Under the ashes was 17 inches of leaf mould. To the south of the center were several bricks, a few inches in the leaf mould. It was evident that there had been some recent white man's work on the site of the circle, probably a sugar boiling camp. A few animal bones and a few potsherds, and several flint chips were found. On clearing out under the recent ash-bed we came to about 2 inches of very black old ashes on the

surface of the clay 17 inches from the surface of the leaf mould. In this bed of ashes were a few flint chips and fragments of pottery. The only thing found in the recent upper bed was a fragment of pressed brick showing its recent origin.

Circle 3 was about 40 feet south of 1. It consisted of an embankment 9 feet in width and had a diameter of 43 feet inside the embankment. Number 4 consisted of an embankment 12 feet wide which adjoined that of 3 on the southeastern side. The diameter from outside to outside was 58 feet. These circles yielded finds similar to those above described.

These circles certainly are the remains of houses or huts. As has been pointed out above it seems probable that these were the habitations of the later dwellers on the site, since the successive villages seem to have moved from the southwestern portion of the plateau in a northeasterly direction, probably owing to the accumulation of debris on the site and the large number of burials.

ARTIFACTS FROM THE SITE

BY CHARLES C. WILLOUGHBY

General Distribution of Types. In studying the artifacts from this site, it should be remembered that most of them are of types used at the time of, or immediately preceding, the first intercourse of the northeastern Indians with Europeans. Perhaps the most distinctive stone implements are the mullers or pestles having a flat expanded base, the discoidal stones, and the chipped adze blades. Broadly speaking, these three types are characteristic of an area enclosed by a circle about five hundred miles in diameter, with its center near Louisville, Kentucky, and taking in the greater portion of Ohio, Indiana, Illinois, Kentucky and Tennessee. It is almost wholly within the Algonquian and Iroquoian areas.

The distribution of certain types of shell objects from the site is probably about the same. On the other hand, most of the ordinary forms of stone implements and shell ornaments have, of course, a much wider range.

So far as the distribution of the rarer types of antler and bone objects is concerned, but little data outside of Ohio are available for comparison. Probably the most distinctive and least widely ranging group of artifacts is the pottery. The group seems to be confined principally to southern Ohio and certain portions of Indiana and Kentucky.

Knives and the Larger Projectile Points. On plate 5 are illustrated most of the forms of flint knives recovered from the cache-pits and general refuse. It is, of course, possible that some of these may be projectile points, but the greater number were probably knife blades which were hafted in short wooden handles and were employed in the manifold uses to which the implement is adapted. In looking over the large number of tools made of antler, and the chips and refuse pieces of this material found everywhere upon this site, abundant evidence is shown of the efficiency of the flint knife as a cutting implement.

Perhaps the most interesting example in the collection is shown at k. This is made of white flint, and the broad blade, comprising the upper one-fourth of the implement, is thin and beautifully chipped to a sharp cutting edge. Its lower three-fourths forms the handle, which was undoubtedly wrapped with buckskin or similar material as a protection to the hand.

The knife or scraper figured in n, is of the uncommon beveled type. It is a little less than half an inch thick, with an abrupt chisel-like bevel at the left of the side shown in the drawing, and it also has the usual corresponding bevel upon the other side of the opposite face.

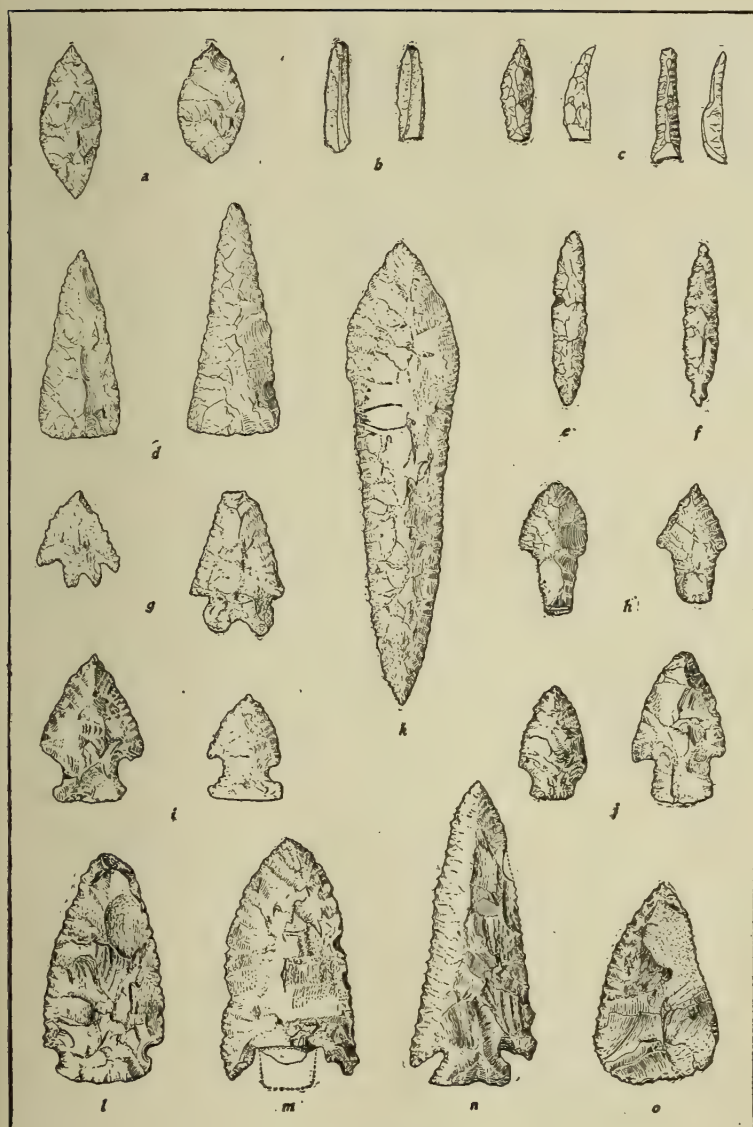
Nearly all knives of this type have the bevel upon the left side when held with the base toward the observer. The reason for this seems obvious, when we remember that most Indians are right-handed, and in using the modern steel curved knife draw the blade toward them in cutting. Experiments show that this form of flint blade with its wide-angled serrated edge is especially useful in working wood.

Very few of the larger blades, such as are illustrated in l, m, o, were found.

It is possible that m may have been a spear point, as the shank, which is broken off, seems to have been somewhat narrow for the attachment of a suitable knife handle.

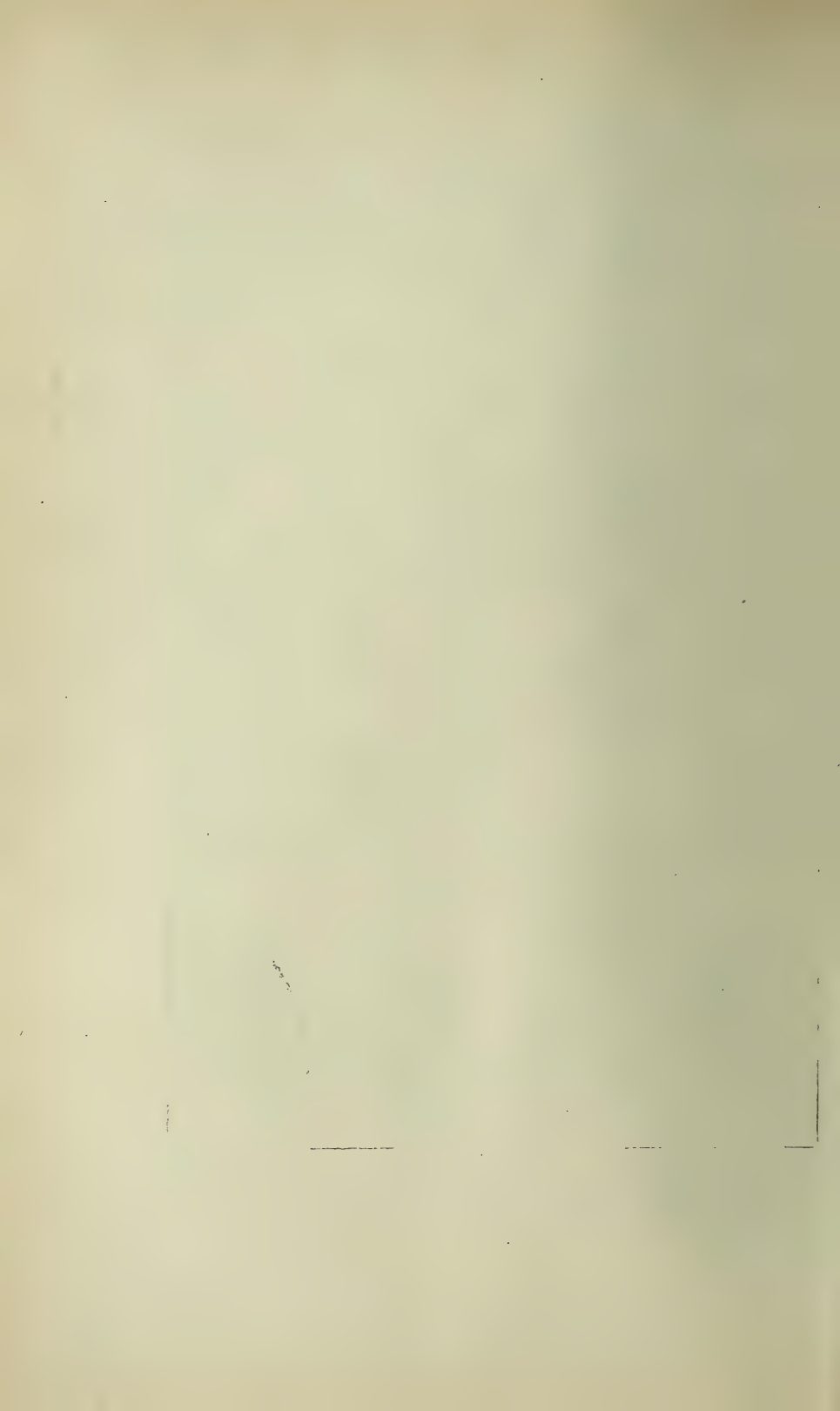
The more ordinary forms of knife blades, such as are illustrated in g, h, i, j, with their broad strong shanks for the attachment of hafts, were fairly common, as were also the thin finely chipped leaf-shaped blades (a) which were probably employed in more delicate work, such as flaying and cutting up animals, cutting out buckskin garments, etc., for which they are especially adapted.

In the *American Naturalist* for January, 1902, the present writer figured and described ten prehistoric hafted flint knives from the cliff-houses and burial caves of the Southwest. The following forms shown on plate 5 were represented: triangular (d), leaf-shaped (a), stemmed (h, j), and notched (i). These were secured to the handles in most cases with a cement made of gum. In one instance the cement was reinforced with twine wrapping, and in another example the notched blade was fastened with sinew. In two instances the blade was set at a considerable angle to the handle. One of the specimens resembled a pocket knife somewhat more than half



MADISONVILLE SITE

Knives, projectile points and scrapers. (About 4.)



open. In the Mexican collection of the Museum are eight prehistoric hafted blades of the leaf-shaped and triangular types, about two and a half to seven inches long, with handles ranging about five to seven inches, which illustrate the manner of hafting the larger chipped implements of these forms. The blades were secured to the handles with gum only.

Very few of the sharp edged flaked knives, shown in b, were found during the explorations. The making of these required exceptional skill, and they were used necessarily for the most delicate work, such as cutting hair and thin dressed skin and trimming feathers, for the edge is very easily dulled.

A considerable number of the ordinary flint rejects and chips were recovered such as are nearly always found upon Indian village sites, but there is no indication that chipped implements were manufactured here in unusual quantities.

Arrowmaker's Tools. On plate 6, a-g, are shown several flint-working punches of antler. A considerable number of these were obtained, the majority being about one and a half inches long and three-eighths of an inch in diameter. A few, however, were larger. These were used undoubtedly with a hammer of stone or hard wood, in flaking suitable pieces of flint from large masses, and for the roughing out of blades and projectile points. In a number of specimens, one end is battered or split from repeated blows of the hammer. Unlike the ordinary antler flakers used in finishing blades by pressure, the ends of these punches are nearly always symmetrically rounded.

A piece of antler from which punches have been cut is shown in h. The antler was worked into a rod several inches long, with an unworked portion at one end for a handle. The rod was then cut into sections. Many of these refuse pieces were found in the debris.

In the accounts of the process of flint chipping by the Indians there are few references to the punch and hammer. It is apparent, however, that their use was wide-spread as a preliminary process to the final pressure flaking by the ordinary antler tools with special working ends. In the collections of the Museum there are examples of these punches from the village sites in other sections of Ohio, from the Iroquoian sites in New York, one good specimen from a Maine shell-heap, and a number from various places in the Mississippi Valley.

Catlin, in describing the process of arrowmaking among the Apache, says that the flint to be worked was placed in the left hand where it was firmly held by two or more fingers. The punch was grasped between the thumb and two fingers of the right hand, and a coöperator sitting in front with a mallet of very hard wood struck the punch upon its upper end. Both the holder and striker sang, and the strokes of the mallet were given in time with the music.¹ This apparently refers to the blocking out of suitable pieces for finishing by pressure flaking.

In his illuminating paper on Yahi archery² Dr. Pope gives an interesting description of Ishi's method of making arrowpoints.

A boulder of obsidian was shattered by throwing a rock upon it. The chunks thus obtained were broken into smaller size by holding a short segment of deer horn or piece of bone against a projecting surface, and smartly striking it a glancing blow with a stone. The resulting flakes of obsidian best suited for arrow heads were roughly three inches long, an inch and a half wide, and half an inch thick.

These were chipped into arrowpoints with the aid of the ordinary pressure flaker of antler.

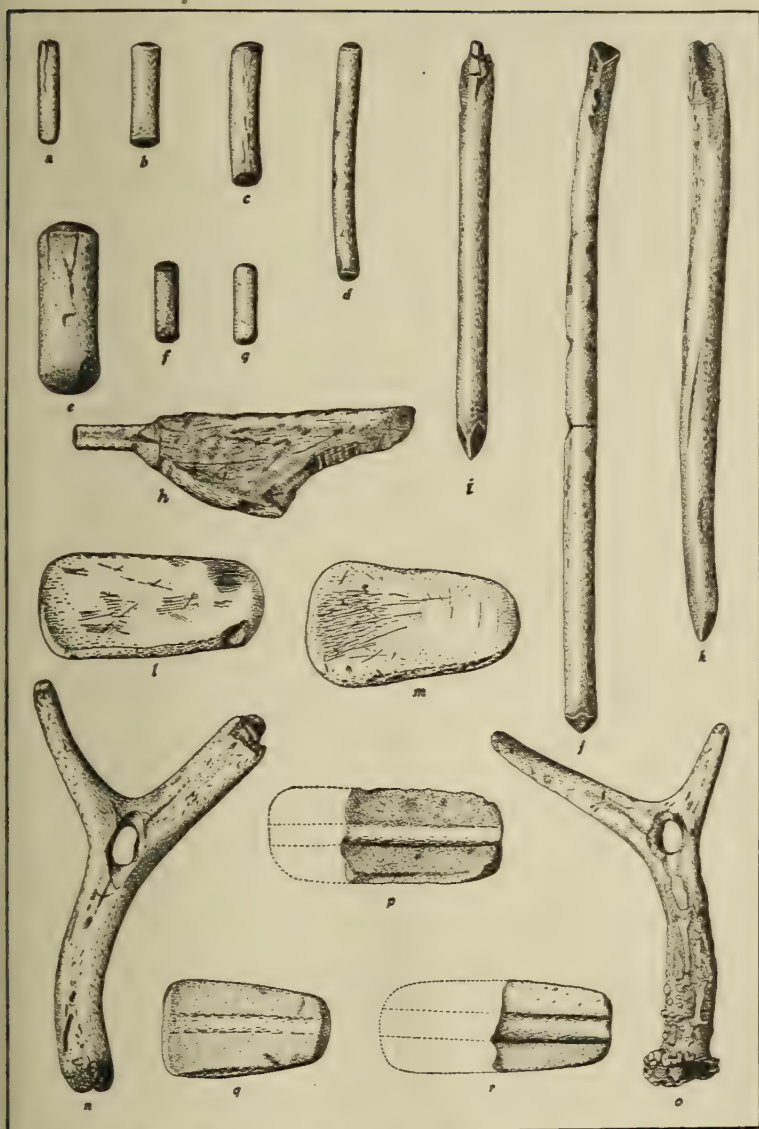
The longer pressure flakers were much less common on this site than the punches. Three of these, made of antler, are shown in plate 6, i, j, k. Their lower ends are specially formed for the kind of work required. They were used in the more delicate flaking necessary in finishing the finer blades and points. These long flakers may have been used without a haft, but some of the shorter ones of the same type from existing tribes are fastened to handles of varying lengths, some of which are long enough to allow the free end to be held between the arm and body of the worker.

The relatively large number of the short antler punches found in comparison with the long pressure flakers (the ratio being roughly about one hundred to one) would seem to indicate that the smaller punches may have been used in the final flaking of at least a considerable portion of the coarser chipped implements.

Figures l, m, plate 6, represent examples of a certain group of stones, showing abrasions and other marks of use, which probably served in preparing sinew and perhaps as hammers for antler

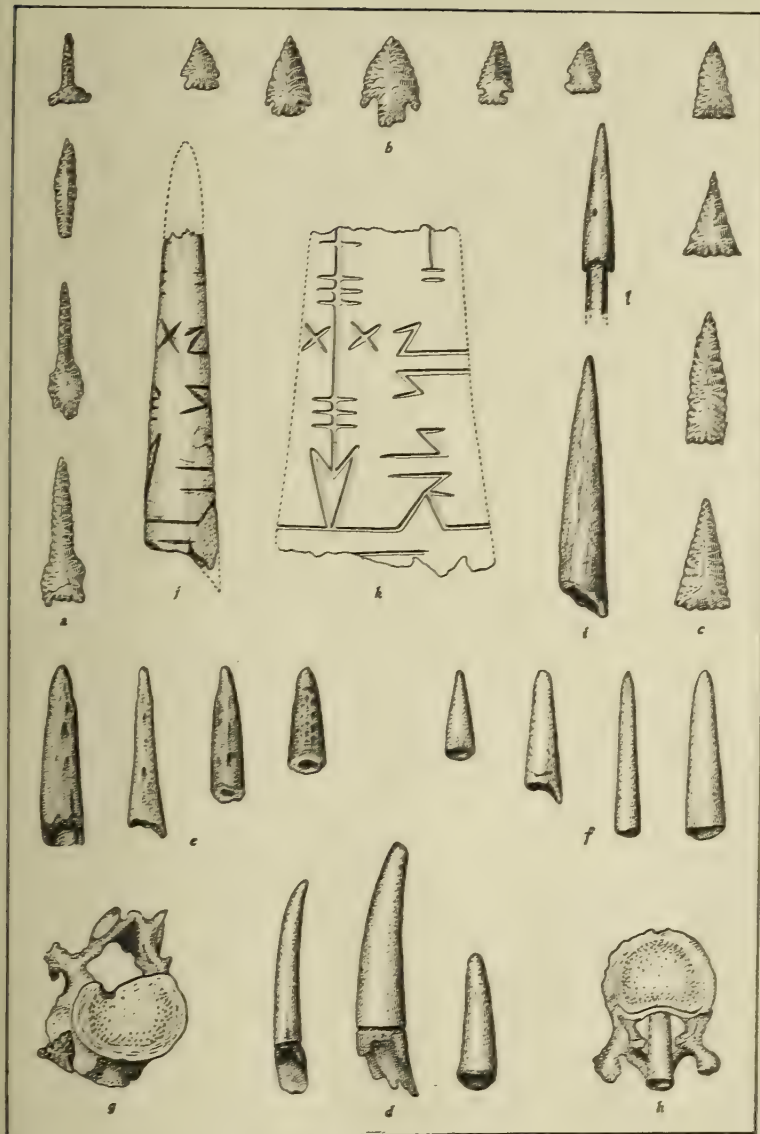
¹ George Catlin, *Last Rambles*, pp. 184-185.

² Saxton T. Pope, *Yahi Archery*, Univ. of Calif. Publications, Amer. Arch. and Eth., vol. xiii, pp. 116-117, and plate 27.



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Arrowmaker's tools; *a-g*, Flint-working punches of antler; *h*, worked antler from which a punch has been cut; *i-k*, Antler tools for pressure flaking; *l, m*, Arrowmaker's stones; *n, o*, Arrowshaft wrenches; *p-r*, Arrowshaft finishers. (About $\frac{1}{2}$.)



MADISONVILLE SITE

a, Flint points for drills; *b*, *c*, Flint arrowpoints; *e*, Unfinished arrowpoints of deer antler; *f*, *i*, Finished arrowpoints of antler; *d*, Tips of antler from which arrowpoints are made; *j*, Spear point of antler with incised decoration; *k*, Design incised upon *j*; *g*, Flint arrowpoint embedded in human vertebra; *h*, Antler arrowpoint embedded in human vertebra from a grave at Turpin's Farm, near Madisonville; *l*, Antler point on very old arrow from the southeastern Indians. (About 1.)

punches in arrowmaking. Stones of like character were found with three arrowmaking outfits in Iroquoian graves during the Peabody Museum explorations in western New York.

On the same plate, n, o, are shown two arrowshaft straighteners of antler. These were used in preparing the twigs out of which the shafts were made. The twig was heated and passed through the hole in the implement which was used as a wrench or lever to straighten its bends and irregularities. Arrowshaft straighteners of wood, horn, and ivory, from the Eskimo, Athapascan, Shoshonean and other tribes are in the collections of the Museum. In this connection it is interesting to note the resemblance of these Madisonville implements to the so-called "bâtons de commandement" of the French caves, some of which were probably used to straighten the shafts of arrows or darts. The end of the small tine of the straightener, shown in n, is rounded and smooth and has evidently been used as a flaker.

Specimens of the typical sandstone arrowshaft smoothers or finishers are illustrated in p, q, r. Most of the examples found were fragments. In use, the shaft was drawn through the grooves of a pair of these stones held faces together in the hand.

Arrowpoints. Plate 7, f, shows four specimens illustrating the range in size and form of the antler arrowpoints, which are relatively abundant on this site. Those having a barb are comparatively rare. A number of unfinished points were recovered which illustrate clearly the process of making. In d, are figured two antler tips which have been encircled by a groove and then broken off. These were evidently cast aside for the reason that it would involve more labor to cut away the broken portion below the groove, than to groove another tine and break it squarely off as in the third example. After detachment the tip was trimmed down and shaped as illustrated in e, probably with a beaver tooth chisel or flint knife, then drilled and finished by grinding or scraping.

These points have a wide distribution and were used over a considerable portion of the central and eastern United States. Beautiful examples are in the collections of the Museum from the Ohio burial mounds, and also on very old historic arrows from the southeastern Indians. One of the latter is figured in l.

An antler point of this type embedded in the vertebra of a human skeleton is shown in h. This was taken from a grave at

Turpin's Farm not far from Madisonville. The Indian had been shot from behind.

The point figured in i, seems to be too large for an arrow and it may have been used on a small spear. Only a very few as large as this were found. The specimen illustrated in j, however, is undoubtedly a spear point. The design shown in k, consisting of crosses, zigzag lines, and what seems to be an inverted spear with ornamented shaft and large head, is cut upon it in incised lines. This is from a cache-pit in Trench H.

So far as can be judged from the specimens collected, the triangular flint points of the type illustrated in c, seem to have been the favorite among these Indians, although the antler points above described were nearly as common. They are made mostly from a yellowish gray flint of various shades and are quite delicately chipped. This form was also the favorite among the Iroquoian tribes. A vertebra of a skeleton from Trench D with one of these points embedded in the bone is shown in g.

Very few notched or stemmed arrowpoints were recovered. Some of these are illustrated in b. One cannot be certain, however, that all were used as points for arrows, although most of them probably were, as they seem too small for knives, and the width of the bases between the notches is not sufficient for the attachment of a practical knife handle.

Flint Drills. Several flint drills are represented in a, of this plate. A considerable number of these were obtained from the cache-pits and general debris.

A few drills of like form, hafted in wooden handles, have been taken from cliff-houses and burial caves in the Southwest, which indicate in general the probable method of hafting the Madisonville specimens. The most common way seems to have been to insert the broad end of the drill into a notch in one end of a handle six or eight inches in length, where it was secured with pitch and twine wrappings. This handle or shaft was twirled between the hands, or with the aid of some mechanical contrivance like the bow, which was in use for this purpose in the Southwest previous to the arrival of the Whites. Another method is shown by a specimen from Colorado. A short stick was split through the center, and the broad face of the drill was placed between the two pieces at about equal distance from the opposite ends, with the drill



MADISONVILLE SITE

a, Beaming tool made from the femur of the puma; *b*, *c*, Beaming tools made from the cannon bones of the deer; *d*, Beaming tool made from the spinal process of the buffalo; *e-j*, Flint scrapers. (About $\frac{1}{4}$.)

point projecting at right angles to the length of the stick. The two halves of the handle were then bound securely together. In use the handle must have been grasped with the drill projecting between the two middle fingers.

Skin-dressing Tools. On plate 8 are illustrated four bone beamers for removing the hair from skins which were first made wet and folded, or left in a pile until the hair became loosened by fermentation. The skin was then thrown hair-side uppermost over a rounded piece of wood or section of tree trunk. The beamer was seized with one end in each hand, and applied to that portion of the skin lying over the beam. A light scraping with the sharp edges of the tool rendered the skin clean and free from hair. By far the greater number of beamers were made from the cannon bones of the deer. Two of these are shown in b, c. Fragments of several hundred of these were obtained. They were usually broken near the middle as this was the thinnest and most fragile part of the tool. Only a comparatively small number of unbroken ones were recovered. Among these are a few which are unfinished and clearly show the process of making. One method was to widen and deepen the natural longitudinal groove on the broad face of the bone, probably with the rounded edge of a flint scraper, until the required sharp edges upon either side were produced. Another was to cut a longitudinal slit through the wall and scrape away the bone upon either side until the proper edges were formed.

As the edges became dulled by use they were again sharpened by scraping, and the process was repeated until, in many instances, the middle of the tool became so weakened that it apparently broke in use and was thrown aside.

Another favorite bone from which beamers were made was the long spinal process of the buffalo (d). These were less common than those made from deer bones. Fragments of sixty or seventy were recovered, together with a few perfect ones. Their length ranged from about eleven to sixteen inches. Other bones of the buffalo were rarely found in the refuse.

It is probable that during the occupation of this site, buffalo were not uncommon in the section of the Little Miami Valley which the village overlooked. If they were hunted to any great extent, however, the Indians evidently brought the meat to the village upon the headland, leaving most of the bones, excepting such as were

selected for the making of implements, in the valley. Zeisberger,¹ who wrote in 1780, says the buffalo at that time were found near the mouth of the Muskingum, and were reported in considerable numbers along the Scioto.

Judging from the large number of bones of the deer in the refuse of the site, it seems to have been the favorite food animal of these Indians.

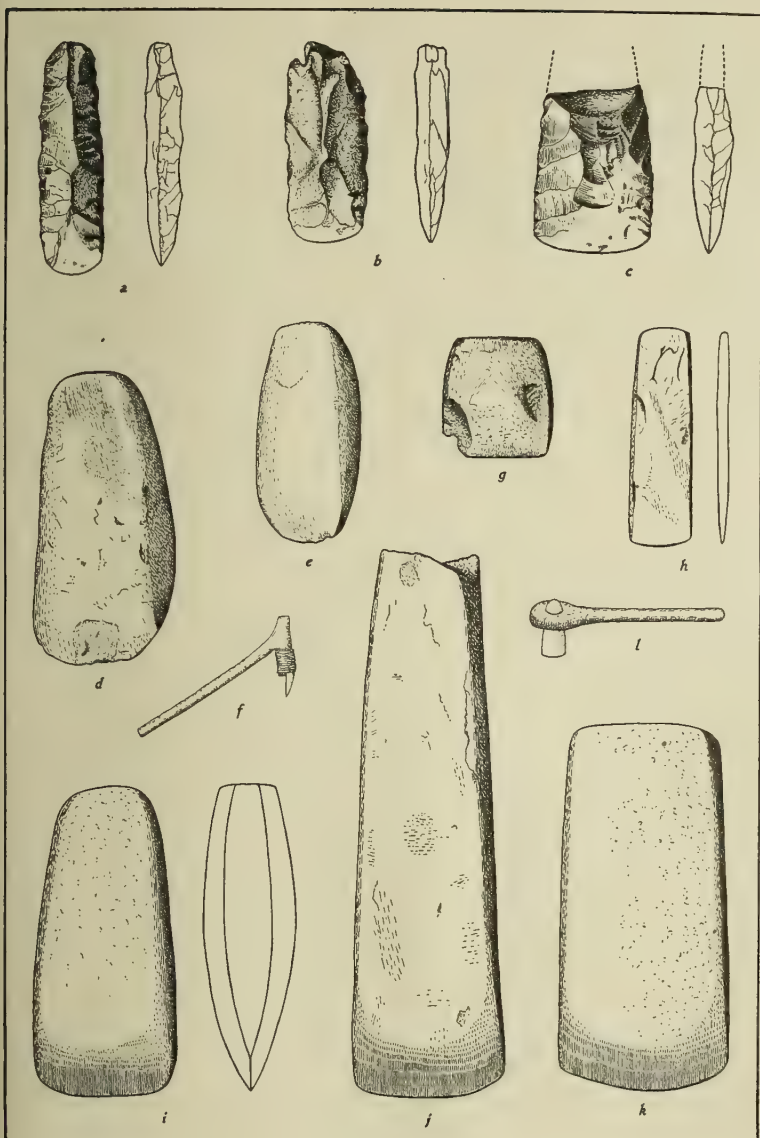
A very few beamers were obtained wrought from the larger leg bones of the deer and elk. The example shown in a, is made from a femur of the puma.

The more essential tools employed in skin-dressing are the beamers above described, and the scraper or "grainer," which is used for removing from the inner side of the skin the adherent fat and skin muscles, and also for "graining" or softening the skin as it dries. Various kinds of these instruments were in use by Indians in general. They were often made of the tibia of the deer, cut to a chisel-shaped edge which was notched or serrated to render it more efficient. This seems to be a much more practical tool than the adze-like scrapers with smooth edges used for this purpose by some of the tribes of the Plains region. There is no evidence, however, that the people of this site used a bone "grainer" of this form. Another and equally effective tool of chipped flint seems to have been preferred.

One of the most effective skin-scrapers employed in recent times by the Eskimo, but now abandoned among tribes who have lost the art of stone chipping, is the form shown on plate 8, e-j. Among the Eskimo they were usually hafted in short wooden handles elaborately wrought to fit the hand perfectly. They were also sometimes hafted in ordinary straight handles.

Flint blades of this form with their scraping edges often beautifully serrated were recovered in large numbers from the general refuse of this site. They were probably hafted by inserting their narrower ends into straight wooden handles, and were doubtless used largely in skin-dressing, but were probably also employed in working bone and wood. It is not improbable that certain types of antler blades (plate 14, e, f) may also have been used as skin-scrapers.

¹ David Zeisberger, *History of the Northern American Indians*, p. 59.



MADISONVILLE SITE

a-c, Chipped flint adze blades ground near the cutting edge; *d, e*, Adze blades; *g*, Hematite blade; *h*, Small slate blade or chisel; *i-k*, Grooveless axes. (About $\frac{1}{2}$.) The adze blades were probably hafted as shown in *f*, the grooveless axes as in *l*.

Chipped scrapers of erratic shapes, such as occur in most collections, examples of which are shown on plate 5, c, were very rare. Only about a dozen were found during the explorations by the Museum.

Grooveless Stone Axes. Perhaps the most highly developed stone implements from this site are the grooveless axes made of very compact varieties of stone, the majority being carefully formed and polished. Most of these were obtained from cache-pits. Three are illustrated in plate 9, i, j, k, and the common method of hafting is shown in l. Sometimes the shorter blades of this type were set into a hole which did not pass through the handle; but in the majority of cases the haft was perforated and the upper end of the blade projected, as is conclusively shown by five prehistoric examples in their original handles which have been taken from the beds of streams in the Iroquoian and Algonquian areas. In the sixth hafted specimen known to the writer, the blade is set into a hole which does not perforate the handle.

The larger grooveless axes were probably used principally as implements for cutting wood, both with and without the aid of fire, while the smaller specimens may have been employed both as implements and weapons. Most references to stone axes among the Indians by the earlier writers probably relate to the grooveless type. In New England a few were in use in the first half of the Seventeenth Century. Johnson in 1654 refers evidently to this form as follows: "They had a small number of Mawhawks [tomahawks] Hammers, which are made of stone having a long pike on one side and a hole in the handle which they tye about their wrists."¹

Gookin refers to "tomahawks made of wood like a poleaxe with a sharpened stone fastened therein."² And Williams says that trees were felled with a "stone set in a wooden haft."³

As the grooveless axe was evidently highly prized by the occupants of the Madisonville site, it undoubtedly continued in use till replaced by iron blades similar to those illustrated on plate 18, o-r. Very few small stone blades of this class were recovered during the exploration. One of hematite, typical of the miniature axes of this material from Ohio and the neighboring region, is figured (g). This was found in a cache-pit.

¹ Edward Johnson, *A History of New England*, p. 114.

² Daniel Gookin, *Historical Collections*, Mass. Hist. Coll. 1st S. Repr. 1859, vol. i, p. 152.

³ Roger Williams, *Key into the Language of America*, R. I. Hist. Coll., vol. i, p. 130.

So far as the explorations of the Museum show, the grooved axe was unknown to the occupants of this site.

Stone Adze Blades. Very few stone adze blades were recovered. They seem to have held a subordinate place among the implements of this people. The antler blades so common here may have served their needs as well. They certainly were more quickly fashioned and there was an abundance of material from which to make them.

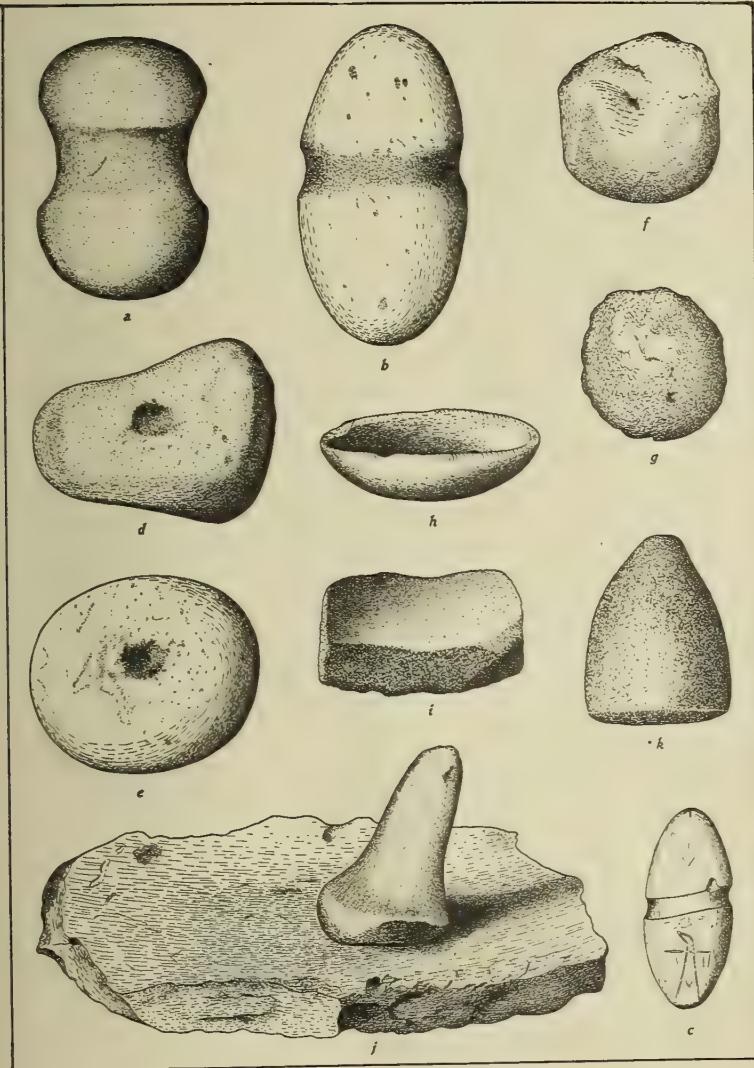
A few chipped stone adzes polished near the cutting edge were found, nearly all from cache-pits. These belong to a type much more common in the region of the lower Ohio and Mississippi Rivers, than in the north. Three are illustrated on plate 9, a—c. They are made of a cream-colored chert or flint. The one shown in a, was found with a skeleton.

Two adze blades of polished stone of the ordinary form are figured in d and e. The larger of the two lay near the right femur of a skeleton in Trench D. The probable method of hafting these implements is shown in f. A small and finely finished blade of compact slate carefully polished is illustrated in h. This was probably used with the aid of fire in making the finer perishable objects of wood which were undoubtedly common among the people, and which the fragment of wooden food bowl, figured in e, plate 21, will serve to illustrate.

Anvils, Hammer-stones, and Grinding Stones. Thomas Hariot, writing of the Virginia Indians in 1587, tells us that each household had stones for cracking nuts and for grinding shell and other materials.¹ This statement would doubtless be equally true if applied at that time to almost any tribe inhabiting the section east of the Mississippi.

Anvils, hammer-stones, and stones for grinding were very abundant on the site under consideration, and must have been common objects in all of the houses. The anvils, or pitted stones, as they are more commonly called, were of the type usually abundant on old village sites. Two of them are illustrated on plate 10, d, e. These stones vary considerably, some of them being much larger than the ones illustrated. Their form and size were, of course, determined by the water-worn stones from which they are made, for they are usually unmodified save for the depression pecked

¹ Thomas Hariot, *A Brief and True Report of the New Found Land of Virginia*, Holbein edition, p. 25.



MADISONVILLE SITE

a, b, c, Grooved club heads; *d, e*, Anvils or pitted stones; *f, g*, Hammer-stones; *h, i*, Mortars or stones for grinding; *j*, Grinding stone and muller; *k*, Muller. (About $\frac{1}{2}$.)

upon one or both sides. It is generally conceded that these household objects are primarily anvils on which acorns, hickory and other nuts were cracked. The bones of food animals were probably crushed on the larger anvils. They also undoubtedly served for other domestic purposes. Some of the smaller ones are battered along their edges, the result of being used as hand hammers.

A considerable number of the round hammer-stones were found, of the type illustrated in f, g, such as occur upon many of the village sites east of the Mississippi. These are usually made of chert, quartzite or other hard varieties, and are thought to have been used among other purposes for pecking or roughing out various stone implements.

A very large number of fragments of sandstone and limestone were found, with one or more abraded surfaces, which had been used for rasping or grinding in the making of various objects of shell, bone, antler, wood or the softer varieties of stone. In some instances these abrading stones were of special forms, like the grooved fragments of limestone shown on plate 21, f-h, which were evidently designed for finishing cylindrical objects of a nature similar to the shafts of arrows or arrowpoint flakers of antler. Slabs of limestone of various sizes were apparently used for grinding corn, acorns, paint and similar materials, one or both faces being worn smooth, or a depression formed by continued rubbing. Two of these are figured on plate 10, i and j. A shallow stone mortar probably for grinding paint or medicine is represented in h.

The pestles or mullers were mostly of the form shown in j, which is the type generally used by Indians of the Madisonville culture over a large portion of Ohio. Another and rarer form is illustrated in k.

Club heads, of the kind figured in a-c, plate 10, were not uncommon. They usually consist of an oblong pebble unmodified with the exception of the encircling groove, although occasionally one is wrought over nearly the entire surface, and in the case of c, the form is wholly artificial. These, as a rule, show no signs of having been used as mauls; they were probably all club heads, the weapon being similar to the well-known warclub of the Plains tribes.

Several well-finished objects of unknown use with carefully ground faces, and made of compact altered slate were obtained

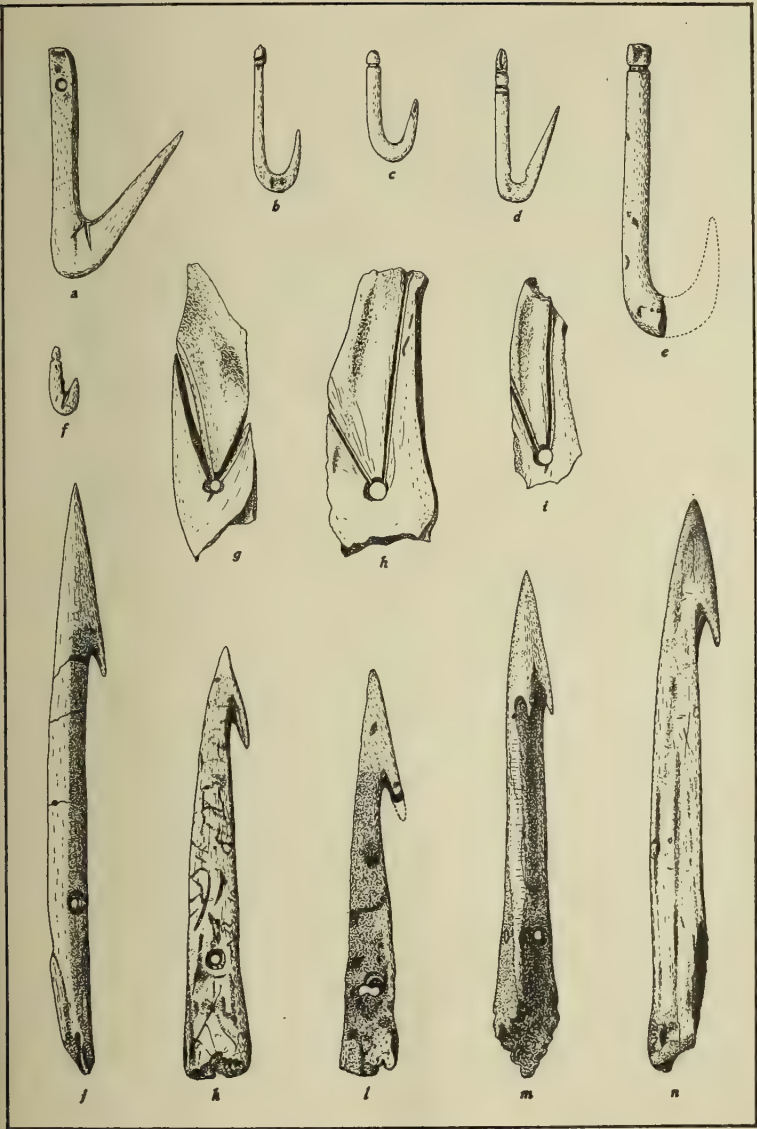
during the exploration. Three of these are figured on plate 21, i-k. They do not seem to have been employed as grinding stones or for preparing sinew. With our present knowledge, no definite use can be assigned to them. Five or six small discoidal stones of the usual type were recovered; two are illustrated in l and m of this plate. The upper one is perforated, and accompanied a skeleton. The one shown in m, was obtained from a cache-pit. They are probably gaming stones, and like the shell gorgets with the characteristic eye markings, seem to connect at least a part of the material culture of this people with that of the tribes more to the south.

The so-called winged ceremonial stones, which form so attractive a group from Ohio, are represented in the collection from this site by a single fragment. This probably belongs to an older culture and doubtless bears no relation to the people under consideration.

Fishing Implements. On plate 11, a-f, are illustrated a number of fish hooks made from fragments of the leg bones of deer or other large animals. These are usually grooved near the end of the shank for the attachment of the line. The one shown at a, however, is perforated at this point. Hooks in the process of making are shown in g, h, i. The fragment of bone was perforated near one end, probably with a flint drill, and grooved or cut through with flint knives. The piece was removed between the grooves which intersect at the perforation, and the hook finished by cutting and grinding. The variation in the size of the hooks perhaps indicates the wide range in the species of fish sought. One broken hook was obtained cut from a unio shell.

The harpoon points shown in j-n of this plate are made of antler. Their bases are irregular and do not seem to have been so carefully fitted to the socket in the shaft as is usual among northern tribes. A peculiar feature of the point, m, is the double barb and double perforation for the line. The harpoons, of which these are a part, were probably used principally in taking large fish. Most of these points are from the general refuse of the village site, but one specimen (l) was found with a skeleton.

Awls and Needles. Some of the more typical awls and needles are illustrated on plate 12. Mat needles made from deer ribs, such as were probably used principally for sewing together flag leaves in making mats for house coverings, are shown in a-c. Compara-



MADISONVILLE SITE

a-f, Bone fish-hooks; g-i, Unfinished fish-hooks showing process of making; j-n, Harpoon points of antler. (About $\frac{1}{4}$.)

tively few were found as they are exceedingly fragile and perishable. These needles seem to indicate that mat coverings were used upon the houses of this village. The mats were undoubtedly of the type so widely distributed in Canada and the northern portion of the United States, which are made of a double layer of flag leaves, so fastened together that the junction of the edges of the leaves in each layer is covered by the central portion of each leaf of the opposing layer. When properly adjusted these mats make a practically waterproof covering.

A number of fragments of needles made of antler and having a circular cross-section were found, most of them showing more or less curvature. Two are illustrated at the left in e. In the third example figured, the upper portion has been much reduced in size, and notches were cut near the tip to which the thread was probably tied.

Several well-polished thin perforators of bone with sharp points were recovered, two of which are shown in d.

A series of antler pins is figured in f. They are well made and vary from one and three-fourths inches to eight inches in length. While they may have been used as bodkins, it seems probable that they were designed for another purpose.

The other implements shown upon the plate are mostly bodkins or perforators such as abound in the refuse of this village site. They are made from various bones of birds and quadrupeds, the tarsal bones of the turkey (g, h), and the ulnae of the deer (k), being favorites. They were used in basket making and for many other purposes.

A number of the type figured in h, made from the upper portion of the tarsal bone of the turkey, are notched along the upper part, as shown at the left in the figure. This is probably to prevent the fiber or thong wrapping, which sometimes serves as a protection to the hand in similar perforators, from slipping.

The specimen shown in i, is a half of a broken beamer made of the cannon bone of the deer. The end has been ground to a thin edge. The implement would be an effective one for use in the construction of coarse splint basketry. Only a few of these were obtained.

Antler Blades. Many blades were found, of different forms and sizes, made of elk antler, but it is difficult to determine their various functions with any degree of certainty. There were several of the

type illustrated on plate 13, a, b, each provided with a deep notch on the inner side near the upper end. In a, the upper portion has been broken off through the original notch, and repaired by cutting a second notch below, more shallow than the first and showing little wear. In the type specimen, b, considerable wear is present at the sides and back, near to, as well as within, the notch. The distribution of the worn surfaces seems to indicate hafting in the manner shown in d. All blades of this form have the base of an antler branch at their back, the lower portion of which in some specimens is considerably worn. It is probable that this abrasion was produced by a withe or stout thong arranged somewhat as in the drawing.

Another blade of similar shape, but probably hafted in a somewhat different manner, is illustrated in c. Upon either side, near its upper end, are shallow notches much worn. These indicate that the hafting must have been similar to that indicated in e.

The cutting edges of these instruments are sometimes well preserved, but they nearly all show wear. Some have the peculiar striae noticeable on certain stone blades generally supposed to have been used as hoes. This wear occasionally extends upward for a considerable distance above the edge, and it is very likely that they may have been used as mattocks. Others may have been employed in working charred wood for which their edges were well adapted.

On plate 14 are illustrated the more common forms. The type represented in d, e, f, was the most abundant. They vary in length from about four to nine inches, and many of them were probably hafted after the manner of adzes. Others, especially those with irregular edges, may have been used as hoes or digging implements in the planting and the care of gardens. One cannot readily understand how implements with edges like those in d and c, could be used advantageously for the ordinary purposes of an adze or scraper, while their employment as digging implements, might tend to produce this irregularity which would in no way impair their value.

Blades with straight or rounded edges, as in e and f, may have served as scrapers in skin-dressing or similar work.

The specimen illustrated in d, is especially interesting as it shows the marks of the binding material, probably bark or split roots, which secured the blade to its handle. The tool had evidently



MADISONVILLE SITE

a-c, Bone needles for sewing mats; e, Bone needles; d, g-l, Bodkins; f, Antler pins. (About $\frac{1}{2}$.)

been in or near a fire which consumed the bindings, leaving the blade blackened and charred where the burning wrappings came in contact with it.

A number of specimens are perforated as indicated in a, b, c, but the holes show little wear. The perforations probably served in some way for securing the lashing which bound the implement to its handle. The specimen, c, has notches near its upper end to assist in hafting. The example illustrated in b, has less conspicuous notches near its upper extremity and also a small notch upon either side below the perforation. The original length of a few of the blades has apparently been much reduced by repeated sharpening.

Beaver Tooth Chisels. The Indians who inhabited the Madisonville site, as well as nearly all the tribes living in the beaver country, used the incisors of this animal for chisels or cutting implements.

Chisels made from the upper and lower incisors are illustrated in plate 15, e. The lower incisors are much more commonly used for this purpose as the curvature is less. The hard outer enamel of these teeth can be ground to a keen edge, and the tool is admirably adapted for making the smaller and more delicate objects of wood, bone and antler. These blades were hafted in short handles, usually of wood or antler. Antler hafts, some of which were probably used with beaver tooth blades, are found on certain Ohio village sites, but none which could be definitely attributed to this use were obtained at Madisonville. One handle of antler is shown in f, plate 15. This, however, more probably served in hafting a small flint blade.

All of the beaver tooth cutting implements obtained during the Museum exploration were of the chisel type. None of the side cutting knives, such as occur also with this form in New England and certain other sections, were found.

Historical references to the use of these implements are rare. Captain John Smith¹ writes of the Virginia Indian:

to make the noch of his arrow, he hath the tooth of a Beaver, set in a sticke, wherewith he grateth it by degrees.

He also says that bone fish hooks were worked out in the same way — "grated as they noch their arrows."

In the collections of the Peabody Museum are two old beaver tooth chisels in wooden hafts, which were obtained years ago from

¹ *Voyages and Discoveries*, Arber edition, vol. i, pp. 364-365.

the Eskimo of Bristol Bay. The sharpened tooth is inserted into a curved perforation running from one end through to the side of the handle. As the tooth becomes shortened by regrinding, it is adjusted by being pushed forward from the side of the haft.

The remarkable wood cutting habits of the beaver undoubtedly exerted a marked influence in the choice of the incisors of this animal for blades of cutting implements, and it is in keeping with what we know of the workings of the unsophisticated Indian mind if supernatural powers were attributed to these tools.

Musical Instruments. About twenty of the flute-like objects of the type shown in plate 15, d, made from the long bones of birds, were found during the explorations by the Museum. They are mostly small, and judging from the unbroken specimens recovered the number of finger holes range from five to nine, the usual number being five or six. The holes were commonly about one-half inch apart, but in one specimen the centers of the perforations are placed about one-fourth inch from each other, too near, it would seem, for its successful manipulation by the fingers of an adult.

These instruments are, of course, distinct from the bone whistles of the modern Plains tribes which have no finger holes, and they differ materially from the small bone flutes of the Pueblo region which have a large orifice near one end like the modern flute.

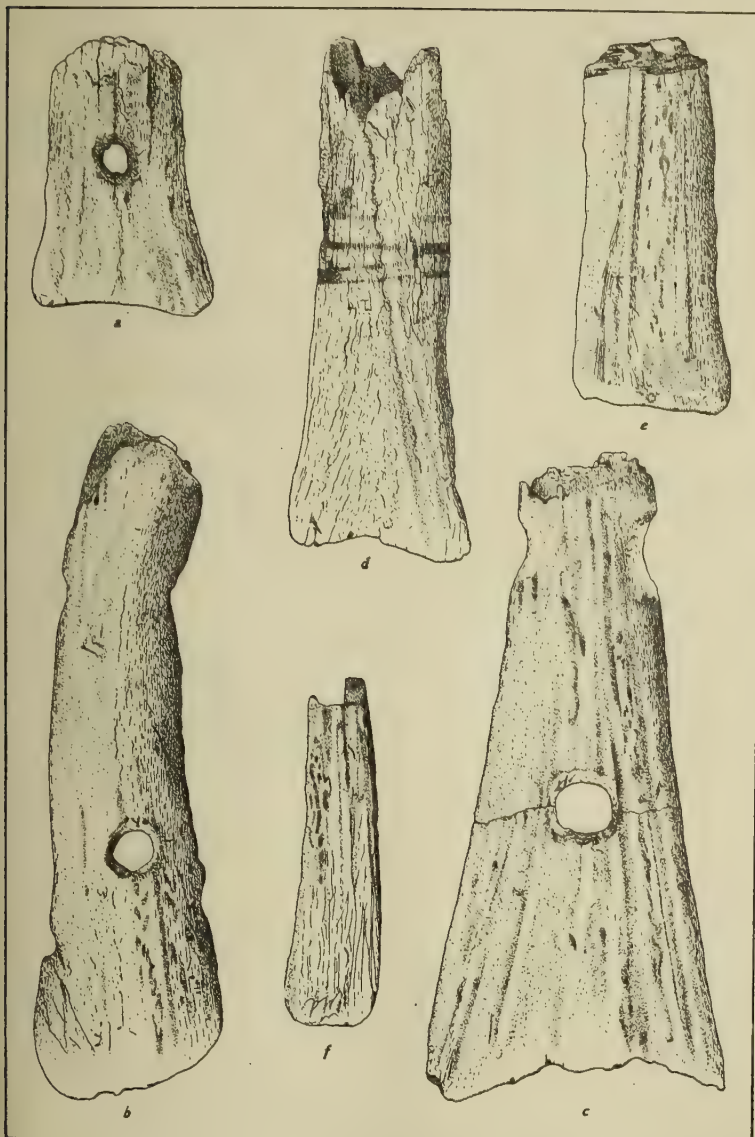
Similar instruments are still found among the Thompson Indians of British Columbia, where they are used by pubescent girls in their ceremonies. The girl's mouth must not touch the surface of the water, so she drinks through a bone tube. These are generally plain, but some of them are furnished with holes along one side so as to be used also as a whistle, from which a number of notes are produced in imitation of various birds. Sometimes birds are called with them. There is in the Museum, an instrument of this type collected by Mr. James Teit which is almost a duplicate of some of the Madisonville specimens.

A considerable number of fragments of ribs of deer and elk were found with shallow transverse grooves, about one-fourth to one-half an inch apart. Two of these are shown in b and c, plate 15, and an unbroken specimen is illustrated in a. In addition to the transverse grooves this example is notched along the convex edge, these notches apparently having no relation to the grooves. A few small ribs were also found without the transverse grooves,



MADISONVILLE SITE

Blades made of elk antler, about $\frac{1}{2}$ natural size, probably hafted as shown in *d*, *e*.



MADISONVILLE SITE
Blades made from elk antler. (About $\frac{1}{2}$.)

but having notches close together along the convex edge. These may have been tally sticks or possibly tools for smoothing pottery, and probably bear no relation to the above specimens. A number of fragments of the former type show considerable wear along the center of the grooved side, and in some instances the grooves at this point have been worn partially or wholly away, as illustrated in b, by the continued rubbing of the scapula or other accessory used in producing the sound.

There can be no doubt that these specimens are analogous to the well-known notched sticks used for marking time in the dances of the Pueblo Indians. When in use these sticks usually rest upon a resonator made of a hollow gourd and are scraped along the notches with the scapula of the deer, thus producing a sharp rattling sound. Similar instruments made of the notched cannon bones of the deer and used with scapula scrapers are also found among the Huichol Indians of Mexico;¹ and notched human femora and tibiae, which undoubtedly served a like purpose, were taken from graves by Dr. Lumholtz at Zacapa, Mexico.²

In the West Indies notched gourds were used for this purpose, and notched sticks, with a plain stick for a scraper, are reported from the Utes and from the Iroquois of New York State.³

Personal Ornaments of Shell. A considerable number of personal ornaments made of shell were obtained from graves. The species most commonly used was probably *Fulgur perversa* from the coast of Florida, although a number of specimens made apparently from *Fulgur carica* were found.

The common unio shells of the inland streams, used so extensively for spoons and implements, do not seem to have been very highly valued for the production of ornaments, although several interesting specimens made of this pearly material were recovered. On plate 16, a, c, are shown two gorgets cut from these fresh water shells, one of which has some unintelligible marking in incised lines. A few pendants, were also obtained; two of these are represented in j. A number of crudely fashioned discs (s) approximately one-half to one inch in diameter, which may have been used as dice, were recovered. One might be disposed to consider these unfinished discoidal beads, were it not for the fact that

¹ Carl Lumholtz, *Unknown Mexico*, vol. ii, p. 155.

² *Ibid.*, p. 429.

³ Frances Morris, *Catalogue of the Crosby Brown Collection of Musical Instruments*, vol. ii, p. 184.

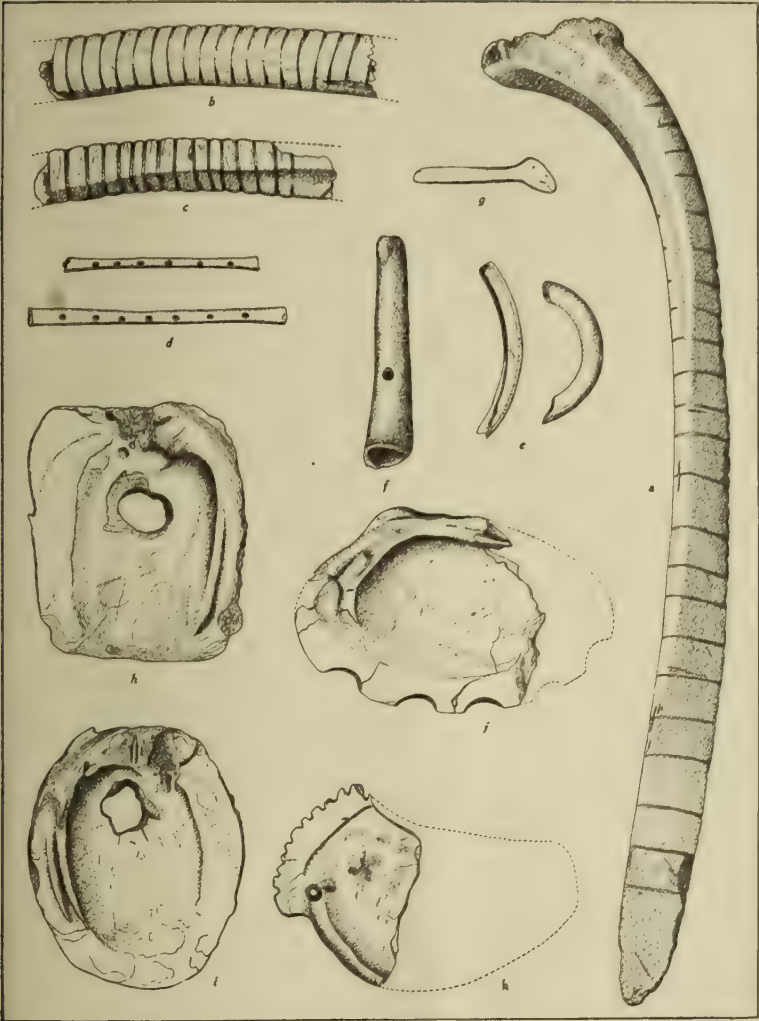
only a very few finished beads of this type were found during the explorations. A large one, from a grave, is shown in t.

The other objects illustrated upon this plate are made from fulgur shells, some of which were undoubtedly obtained by traffic with more southern tribes. The gorget, b, cut from the wall of a large fulgur, was found near the lower jaw of a skeleton. The mask-like gorgets, d-h, with one exception, accompanied skeletons; g was found near the lower jaw of an adult; and d and e are from graves of children. The latter is apparently cut from one of the large circular gorgets having elaborate designs, which are not uncommon in Tennessee and Kentucky. That portion of the original design which remains upon the reverse of the ornament is shown in the drawing. These specimens, all of which represent the conventionalized human face, recall at once the larger gorgets of the same general type from the graves and mounds of Tennessee and Virginia, illustrated and described by Holmes in his *Art in Shell*. That the same deity or personage is represented by the specimens from Madisonville is evident from the design surrounding the eye-like perforations in g, which apparently embodies a like symbolism to that appearing upon the specimens figured by Holmes.

One of a pair of mushroom-shaped ornaments, probably ear plugs, is figured in i. They were found in a grave by Mr. Swanton in 1897. These were cut from large fulgur shells, and are very carefully made, each being a close duplicate of its companion. It is probable that they were obtained by trade from the more southern Indians, as similar specimens have been taken from the mounds of Arkansas. They are also reported from Georgia. The Arkansas specimens, however, are smaller and relatively thicker and do not have the perforation at the lower end.

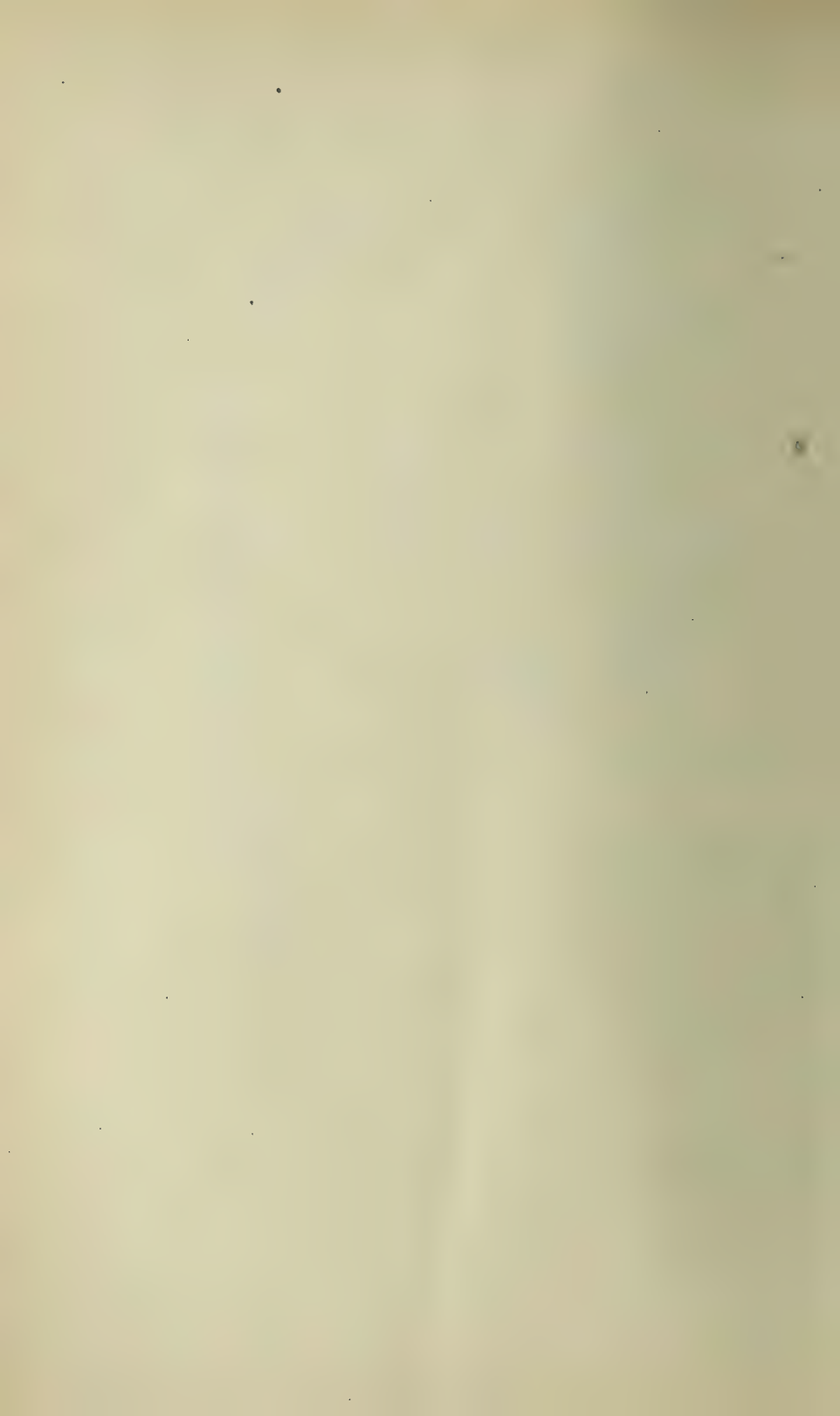
The specimen illustrated in k, resembles the upper portion of the ornament above described. In place of the long projection with perforated end, however, there is a short and much thinner perforated projection standing out at an angle from near the edge of the disc. This specimen was found near the bones of the left hand of a skeleton. A similar but much smaller ornament, taken from a cache-pit, is shown in the drawing below.

In m, n, of the above plate, are figured two of the five pendants made of small fulgur shells. These were found with skeletons.



MADISONVILLE SITE

a-c, Musical instruments made of deer ribs; d, Flute-like instruments; e, Beaver tooth chisels; f, Antler handle; g, Implement of bone; h, i, Scrapers of u. lo shell; j, k, Combined spoons and cutting implements. (About $\frac{1}{2}$.)



The shells are unworked, save for a groove or perforation near the smaller end for attaching the cord. Three of these are made from the shells of *Fulgur perversa*; the others from *Fulgur carica*.

Only two small "pins" wrought from the columellae of fulgur shells were obtained during the explorations by the Museum. One is represented in r. Both were found with skeletons. Although now somewhat disintegrated, they originally bore a general resemblance to the well-known shell pins from the graves of the Tennessee region, but the heads are much flatter.

Considering the number of burials, very few shell beads were recovered. Nearly all were made from the columellae of fulgur shells. As a rule, only a few small beads of the type shown in p, occurred with a skeleton. These were usually found at the wrist or neck.

The large massive beads, q, made from the columellae of *Fulgur perversa*, occurred singly or in groups of two or three. Only one necklace worthy of the name was obtained during the explorations. This was found with a skeleton by Mr. Swanton and consisted of fifty-five beads of nearly uniform size, made from the columellae of *Fulgur carica*, a species common as far north as Cape Cod. Seven of these are illustrated in o. With this skeleton were also found several copper beads and pendants, the copper ornamented belt and the iron bead illustrated on plate 18, g and s, and also two very large shell beads.

There were a few pieces of bone or shell without perforations which may have been used for inlaying in wood, an art in which some of the Algonquian tribes were proficient. One of these pieces cut from unio shell is illustrated in l.

A very few of the small marginella shells, with a portion of the shoulder ground away to make a perforation for the passage of sinew thread, were taken from graves. These were probably used in forming designs upon cloth or buckskin, to which they were sewed. Probably the finest example of this work extant is the "Powhatan" mantle in the Ashmolean Museum. This is figured on plate 15 of the tenth volume of the Reports of the Bureau of American Ethnology.

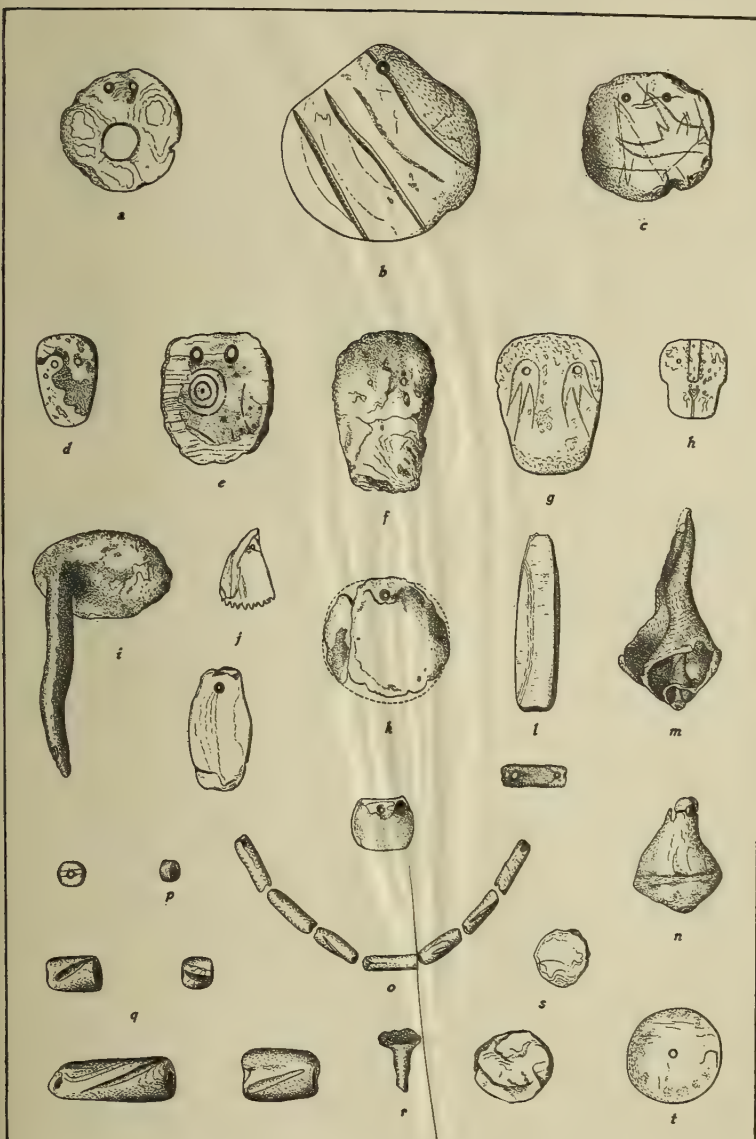
Implements and Utensils of Shell. Unio shells were found in large numbers in the cache-pits and general refuse of the site. The unworked valves were often used as spoons and ladles.

Many of the pottery vessels contained mush or other food when deposited in the grave. They were frequently accompanied by one or two valves of this shell, placed within the vessel to serve as spoons.

In most of the village sites in southern Ohio which belong to the Madisonville culture, a few spoons cut from the valves of this shell are found, having a well-wrought handle upon one side. Such spoons are common in the graves of Tennessee and Kentucky. They are very rare indeed at this site, only two broken examples being in the Museum collections, one of which is illustrated on plate 15, k. In both of these examples, the handle is furnished with a serrated edge admirably adapted for the cutting of meat and other solid food, which generally makes up a portion of the typical Indian stew. The spoon illustrated has a perforation to receive the suspending cord. A third well-made spoon from this site is preserved in the cabinet of the Literary and Scientific Society of Madisonville and is figured in Holmes's *Art in Shell* in the Report of the Bureau of Ethnology for 1880-1881. This has the serrated cutting edge upon one side, and a short rounded handle which is also perforated for suspension.

An interesting specimen, probably a combined spoon and food cutter, is shown in plate 15, j. The shell is unmodified except near the edge, which is coarsely serrated — probably also for the purpose of rendering it more effective in cutting. Such specimens are rare at Madisonville, but are found more commonly on other Ohio sites of this culture.

Several hundred implements of the type illustrated on plate 15, h, i, were taken from the cache-pits and general refuse. They consist of a single valve of unio shell with a perforation about half an inch in diameter near the center. The posterior point of the valve, in some instances, shows little wear, but in the majority of cases is worn or broken, probably in cutting or hacking. In some of the better preserved specimens this portion shows careful grinding to a well-finished blunt scraping edge, and these were apparently not used for cutting or hacking but for scraping. They may have been employed in skin-dressing. Practically all of these implements have the opposite end near the hinge blunted by breaking away the edge of the shell at this point. This was probably done to facilitate hafting. The great majority of the specimens show



MADISONVILLE SITE
Personal ornaments of shell. (About $\frac{1}{2}$.)



no wear near the central perforation. When signs of wear appear it is usually on the convex side of the shell and towards the hinge.

It is an interesting fact that some of the antler blades of the types illustrated on plate 14 have a bluntly ground scraping edge similar to that of the better preserved shell implements, and it is very probable the perforation in both the antler and shell blades served a like purpose, which was undoubtedly to assist in securing the blade to the haft.

Professor Holmes has discussed the probable manner of hafting these unio blades in his *Art in Shell* above referred to.

Combs and Personal Ornaments of Bone and Antler. On plate 17, a, b, are shown a pair of armlets made from deer ribs. They were found one upon either arm of the skeleton figured at the right in c, plate 4. One is neatly ornamented with incised lines and dots; the other is without ornamentation. A third specimen, illustrated in c, is from a cache-pit. Fragments of several others were found, most of them showing incised markings of a nature similar to the above. These armlets are very neatly made, and each end is perforated for receiving the thong or cord which bound them together and held them in place. DuPratz tells us that the young Louisiana Indian men wore bracelets made of deer ribs softened in boiling water, then bent into the required shape, and finely polished so that they resembled ivory. These ornaments must have been more common than appears from the scant evidence furnished by archaeological investigations. The use of boiling water to soften bone and antler for the purpose of rendering them more easily worked with primitive tools, appears to have been common among Indians in general. The pair of neatly made objects of antler, illustrated in d, were found near the jaw of a skeleton. They appear to have been personal ornaments of some kind, perhaps ear plugs. They are not perforated, the ends being carefully finished by grinding. The central cellular portion of the antler at these points is now somewhat disintegrated, especially in the broken one shown in the upper drawing. A few similar specimens were obtained from the general refuse of the site.

Several pendants, made from deformed tips of deer antler, which had been shaped into crudely-made effigies of the heads of birds or quadrupeds, were recovered. Three of these are shown at e, plate 17, the lower specimen being found with a skeleton. The upper

one of the three illustrated shows a natural resemblance to the head of a bird. This portion of the pendant is unworked. Several canine teeth of the bear, wolf and dog, perforated for suspension, were secured. Two of these are illustrated in j. A few perforated elk teeth were found, but these were not abundant, and do not seem to have been in general use.

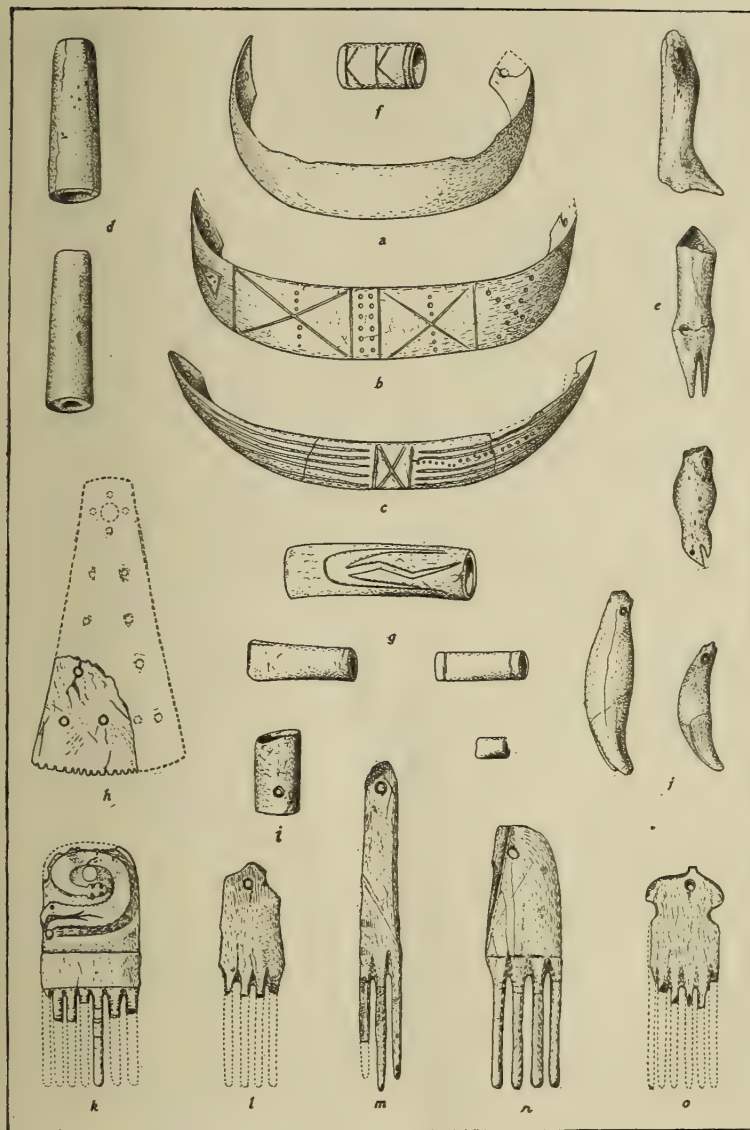
Beads of various sizes, consisting of cylinders cut from the large bones of various birds, were found in graves and in the general refuse. A number of these are illustrated in f, g. Most of them were without ornamentation, but a few were decorated with designs in incised lines. The largest figured in group g, is one of ten found with a skeleton. They extended in a row "from the mouth to the arms and down them." Seven of the beads bore the design shown in the illustration. This design appears also upon a number of other objects from the site, as will be seen by referring to plates 16, 19, 20. It is evidently in part a lightning symbol, and is found most commonly surrounding the eyes of the human face in a certain class of shell gorgets, one of which, a small one from this burial place, is illustrated in g, plate 16. Large shell gorgets bearing this general design occur most frequently in Tennessee and Virginia.¹ The same figure occurs surrounding the eyes of birds, serpents and human beings in numerous drawings and sculptures from various sections of the Mississippi Valley.

A fragment of the bone base of a holder for an eagle feather is illustrated on plate 17, h. The broken lines indicate its original form, which may be duplicated by recent examples in almost any large ethnological collection from the Indians of the Interior Basin.

One of the cylinders which holds the feather and fits over the large hole in the narrow end of the base of these ornaments, is figured in i. There is a hole upon either side near the lower end for the thong, which passes also through the perforations upon either side of the large hole in the base to which it is tied. This thong also serves to fasten the ornament to the lock of hair on the crown of the warrior.

The base, supporting an upright bone cylinder and feather, and worn nearly in a horizontal position, with the broad end projecting backward, is placed within an ornament of upright deer hair dyed

¹ See W. H. Holmes, *Art in Shell*, Rept. Bureau of American Ethnology, vol. ii, plates 67-69.



MADISONVILLE SITE

a-c, Antler arm-bands; *d*, Cylinders of antler, perhaps parts of ear-ornaments; *e*, Pendants in form of bird heads made from diseased tips of deer antler; *f, g*, Bone beads; *h, i*, Bone base and cylinder for supporting eagle feather in head-dress; *j*, Canine teeth pendants; *k-o*, Antler combs. (About $\frac{1}{2}$.)

red and fringed with the black "beard hair" of the turkey or long stiff hair of the porcupine. Taken altogether it forms a very handsome and striking head ornament, and was worn by warriors of various tribes over a considerable area.

The fragment of the base was found in a cache-pit. Only two or three of the cylinders were recovered during explorations by the Museum.

Five antler combs are shown on plate 17, k-o. These are all from cache-pits, with the exception of k, which lay near one of the skeletons illustrated in c, plate 4. Upon the upper portion of this comb is engraved a rattlesnake. Each of the combs is perforated near its upper end for the suspending cord. In two of the specimens, k and n, horizontal striae are noticeable upon the teeth, which are evidently caused by long continued use of the implement, for dressing the hair or for a similar purpose. Combs of like form, but with more pointed teeth, are often used by the Eskimo for combing and renovating the hair of their skin garments.

Personal Ornaments of Copper. A considerable number of metal objects were found with skeletons, and in the cache-pits and general refuse. Most of these were in the form of cylindrical copper beads of various sizes, made by rolling small pieces of sheet metal into tubular form. The majority of these are probably wrought from native copper, but some are undoubtedly made of European copper. It would be difficult, if not impossible, to determine even approximately the number belonging to each group without a chemical analysis of the metal. Most of the smaller beads of the longer type, however, appear to be of native metal, for they are, as a rule, more crudely fashioned than the larger specimens. No single individual appears to have been the possessor of more than a few copper beads. In the graves they were usually found singly or in groups of only a few, sometimes in company with beads of shell. Plate 18, a, shows the various forms. The six small beads in a row of nearly uniform size, were taken from near the wrist of a skeleton, and probably formed part of a bracelet. Those in the lower row were found with the skeleton of a child, and still retain their position on the original string.

A few bell-shaped tinklers are illustrated in f. They were obtained from both cache-pits and graves. In recent times they are made of tin, and are used extensively by the Indians as ornamental

pendants. The smaller end is clasped to a thong, and a bunch of hair, usually dyed a brilliant color, often projects from the larger end.

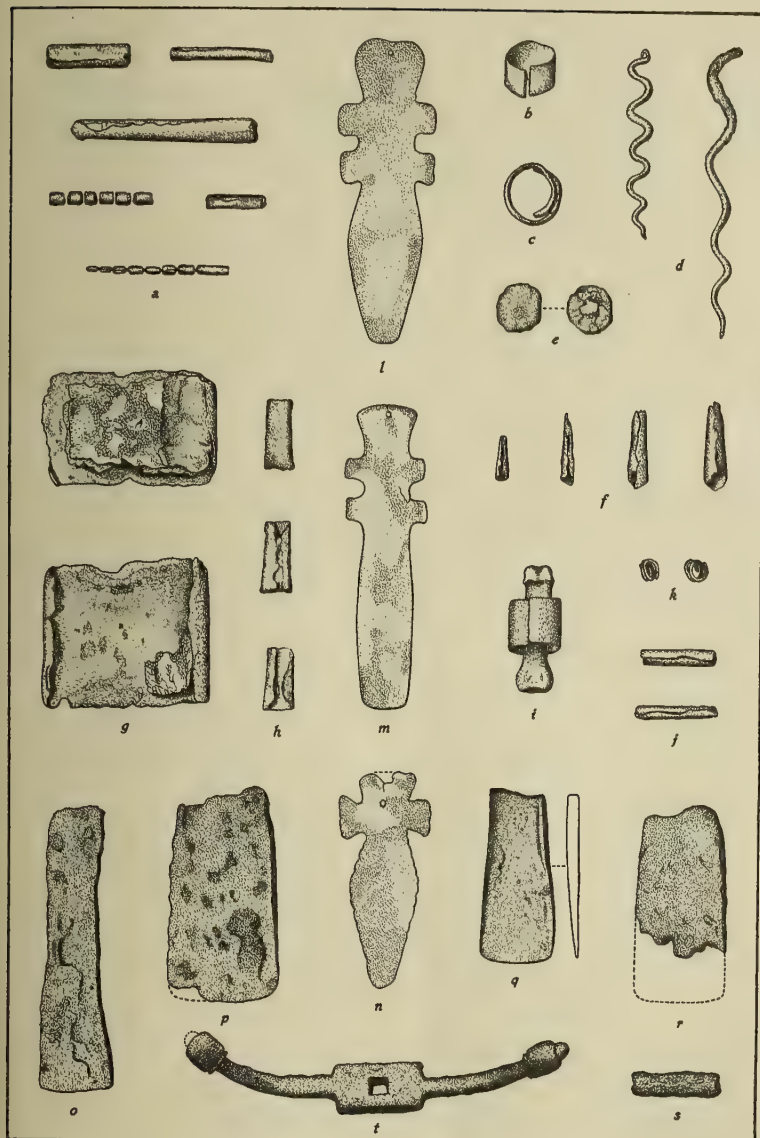
The band bent into a circle and figured in b, was probably for the finger, for four similar rings made of brass and still clasping the phalanges of the fingers of a skeleton were taken from a grave by Professor Putnam. One of these is shown in i. A few rings made of native copper beaten into a small rod and bent into shape (c) were recovered from the cache-pits, as were also the serpent or lightning symbols illustrated in d.

The largest amount of copper found with a burial was taken from Trench I, grave 60, by Mr. Swanton. There were several pieces of sheet copper with one or more of their edges clinched over pieces of buckskin. Two of the larger are figured in g. They lay near the thighs, and seem to have ornamented a girdle. With this burial were also found seven copper beads and pendants, the iron bead illustrated in s, and fifty-five shell beads. Taking into consideration the iron bead, which appears to have been made from a piece of sheet iron, it is not improbable that the copper also may be of European origin, as there seems to be no evidence that the proto-historic Indians of southern Ohio used meteoric iron in fashioning their ornaments, as did the builders of the great earth-works of this region. Small copper ornaments with two of their edges bent over, apparently for securing to thongs, are figured in h. These are from graves.

Only a few examples of overlaying with thin copper sheets were recovered. The first of these were two small pear-shaped objects about three-eighths of an inch in diameter, made of wood and covered with thin copper, which is now badly corroded. The salts of copper have preserved one of the wooden forms perfectly. These were found with the skeleton of a child, in company with several beads and a few coils of copper wire, evidently of native make.

The other examples of overlaying were thin discs of bone, one-half to three-fourths of an inch in diameter, covered on one side with thin copper, the edges of which were turned over and clinched upon the opposite side (e). Vegetal fiber was placed over the discs before the copper sheet was applied.

One of these discs was found beneath the lower jaw of a skeleton. The other three came from a cache-pit. In the *Journal of the*



MADISONVILLE SITE

a-h, l, m, Personal ornaments and other objects of copper; *i-k, n*, Personal ornaments of brass; *o-r*, Iron blades; *s*, Iron bead; *t*, Iron sword guard from grave. (About $\frac{1}{2}$.)

Cincinnati Society of Natural History, July, 1880, p. 131, is figured a crude bell or rattle from this site. It was made of a

single piece of copper of irregular shape, the edges of which have been brought together so as to form a ball, or rather like a sleigh bell, having an irregular opening on one side. A small hole was punched through the top and a strip of copper doubled up and the ends pushed through the opening from the inside, forming a handle. Inside this bell is a fragment of copper about the size of a large pea and when the ornament is shaken it produces a rattling or tinkling sound.

Perhaps the most interesting objects of this metal are the two double crosses illustrated in l, m. The first of these was found with a skeleton by Dr. Metz. The account of the discovery follows:¹

On Thursday, October 28, Skeleton No. 8 was found, an adult male, with head southeast, length 5 feet 8 inches, depth 15 inches. A broken vessel was found at the right of the head, and on the left side a pipe made of limestone, well finished, and carved to represent the head of some animal. A copper ornament was also found at the right of the neck. This relic, which has two bars or cross arms, is made of a very thin piece of copper, rolled or beaten evenly, with a small perforation at one end, doubtless for suspensory purposes.

The other double cross was taken from a skeleton by Mr. B. W. Merwin while conducting work for the Museum in 1911. It lay just to the left of the skull. With the skeleton were also a stone pipe, a flint point on ribs of the right side, and an antler harpoon point near left humerus, (plate 11, l). A flint arrowpoint was embedded in the frontal bone of the skull. These copper specimens at once recall to mind the double crosses of silver obtained by the Indians from the Catholic missionaries. The copper crosses, however, are probably of Indian make. The first example has the appearance of having been roughly cut from European sheet copper, then the surface and edges carefully finished by grinding. The second specimen has more the appearance of being made of native copper. Only a chemical analysis, however, can settle these points.

Personal Ornaments of Brass. A cross cut from sheet brass, and of the same general form as those above described, but having one cross-bar instead of two, is illustrated in n, plate 18. This was found with the skeleton of a child by Professor Putnam in 1882,

¹ *Journal of the Cincinnati Society of Natural History*, July, 1880, p. 133.

together with a few copper beads and spirals of brass wire, and a pottery vessel of the usual type having four ears or handles. One of the beads is shown at the left in the upper row in a, and two of the spirals are illustrated in k. This is one of the most instructive burials found during the explorations, as it definitely connects this form of cross with the proto-historic period, and also proves that the pottery vessels of the type so characteristic of this cemetery were in use at this time.

An interesting copper cross of somewhat similar design, from a stone grave near Nashville, Tennessee, is in the Museum collection. This is illustrated on page 98 of the third volume of the *Reports of the Peabody Museum*. No other object from this group of Tennessee graves shows indication of contact with Europeans, and perhaps this specimen bears no relation to the Christian cross.

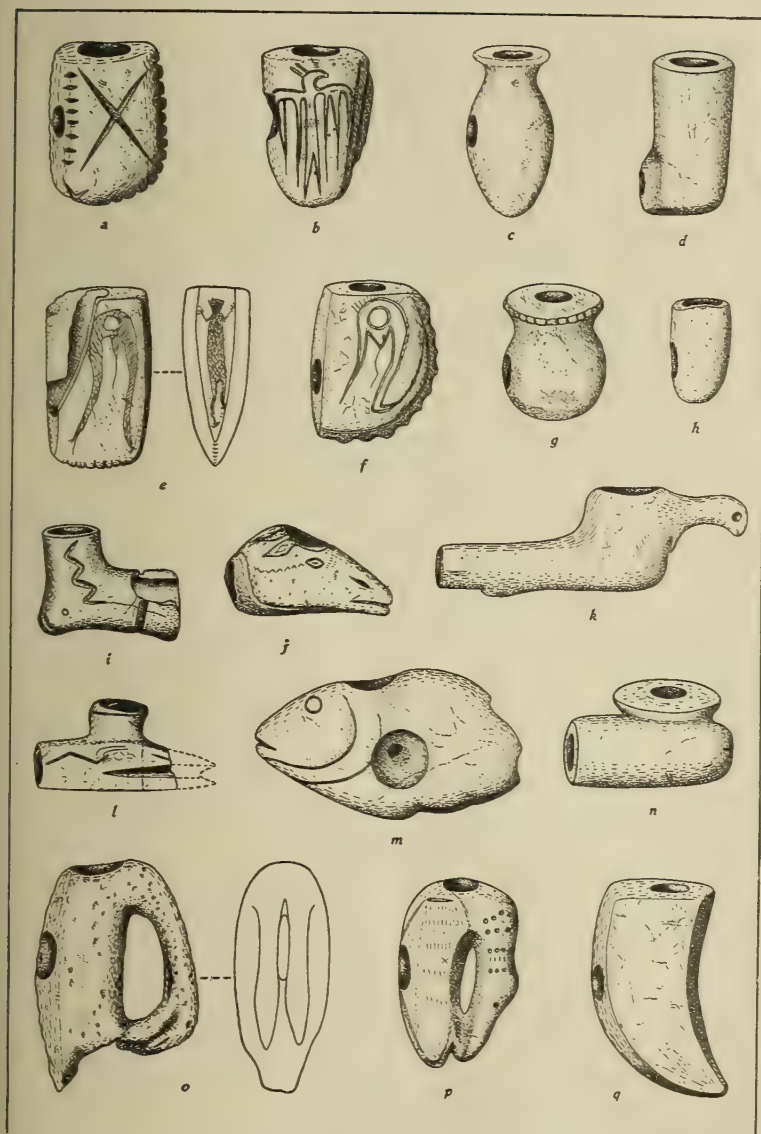
A few beads made of European sheet brass and of the same type as those of copper were obtained from different cache-pits. Two of these are shown in j.

In 1882, Professor Putnam opened a grave in which were the skeletons of a woman and child. Accompanying them were twenty-two copper beads, varying from one to two and one-quarter inches in length, and about one-quarter of an inch in diameter. On the first phalanges of the first and second fingers of each hand of the woman, were rings made of bands of sheet brass, about three-fourths of an inch wide and two and one-half inches long, each bent into a circle with the ends of the strip overlapping. One of these is illustrated in i. A number of fragments of both sheet brass and sheet copper were found in the general refuse of the site.

Iron Objects. On plate 18, p, is shown what is apparently a badly corroded iron adze blade. It was found four feet beneath the surface in a cache-pit. A second blade is illustrated in r, from three feet one inch below the surface in another pit. Both of these were recovered by Mr. Swanton. Two more of the same general form are figured in o and q. These blades were obtained by the Indians either directly or indirectly from white traders.

In the leaf mould, and in one instance twenty inches beneath the surface of a cache-pit, fragments of iron objects were found which were probably lost by the early white settlers of the region.

The only iron objects obtained from graves are the bead illustrated in s, already referred to on page 70, and the sword guard



MADISONVILLE SITE
Tobacco pipes. (About $\frac{1}{2}$.)

shown in t. The latter was found over the chest of the skeleton of an adult female. There were also three bone beads at the neck and six copper beads near the hands of the skeleton. I have been unable to ascertain with any degree of certainty the probable origin of the European sword guard or the approximate date of its manufacture.

Glass Beads. A few globular blue glass beads, about three-sixteenths of an inch in diameter, were found near the skull of a skeleton of a child, by Mr. Swanton. These were of the same kind as those obtained during the exploration by the Museum of the proto-historic Iroquoian cemetery in Erie County, New York.

Mr. Swanton also found fragments of blue beads in three cache-pits, and Mr. B. W. Merwin reports the finding of one such bead in a fourth pit. The recovery of iron objects or brass or glass beads; from at least nine cache-pits and five graves, seems to indicate beyond question that this site was not abandoned by the Indians till after their contact with Europeans either directly or through their Indian neighbors; but the scarcity of such objects, as well as their nature, also indicates that the site was deserted long before the arrival of English settlers.

Tobacco Pipes. A large number of tobacco pipes were found, the majority being obtained from cache-pits or by general digging. A few occurred with skeletons. Most of them were made from the limestone of the region. Some were of sandstone, while a small number were of other varieties, including serpentine and red pipe-stone. Two or three rude pipe bowls were found made from sections of deer antler, also fragments of four or five pottery pipes, fashioned of fine clay of a kind very different from that used by the inhabitants in making pottery. Judging by the fragments, these clay pipes resembled those of the Iroquoian and Algonquian tribes of the East, and were probably imported from that section. A considerable number of stone pipes in the process of making were recovered, which indicates that most of the finished specimens secured were made by the inhabitants and were not obtained from the neighboring tribes.

The majority of the specimens were of the simple designs and forms figured in plate 19, a-i. They were usually without ornamentation. A few were ornamented with notches or with designs in incised lines, as shown in a, b, e, and f. A very good figure of

the thunderbird is engraved upon both sides of b; while the peculiar eye designs, also occurring on certain shell gorgets, bone beads, and pebbles (plates 16, g, 17, g, 20, a, b), are engraved upon either side of e and f. A small animal figure, probably the totem mark of the owner, is shown on the narrow side of e.

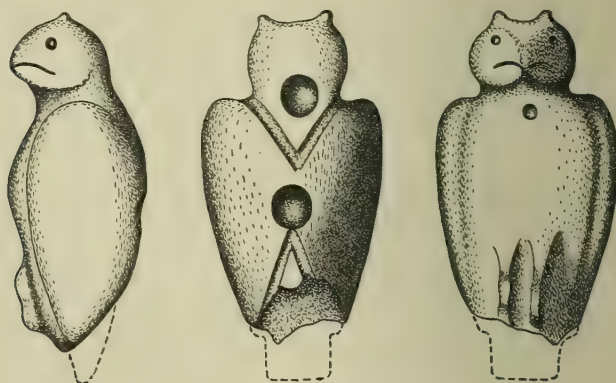


FIG. 5. MADISONVILLE SITE

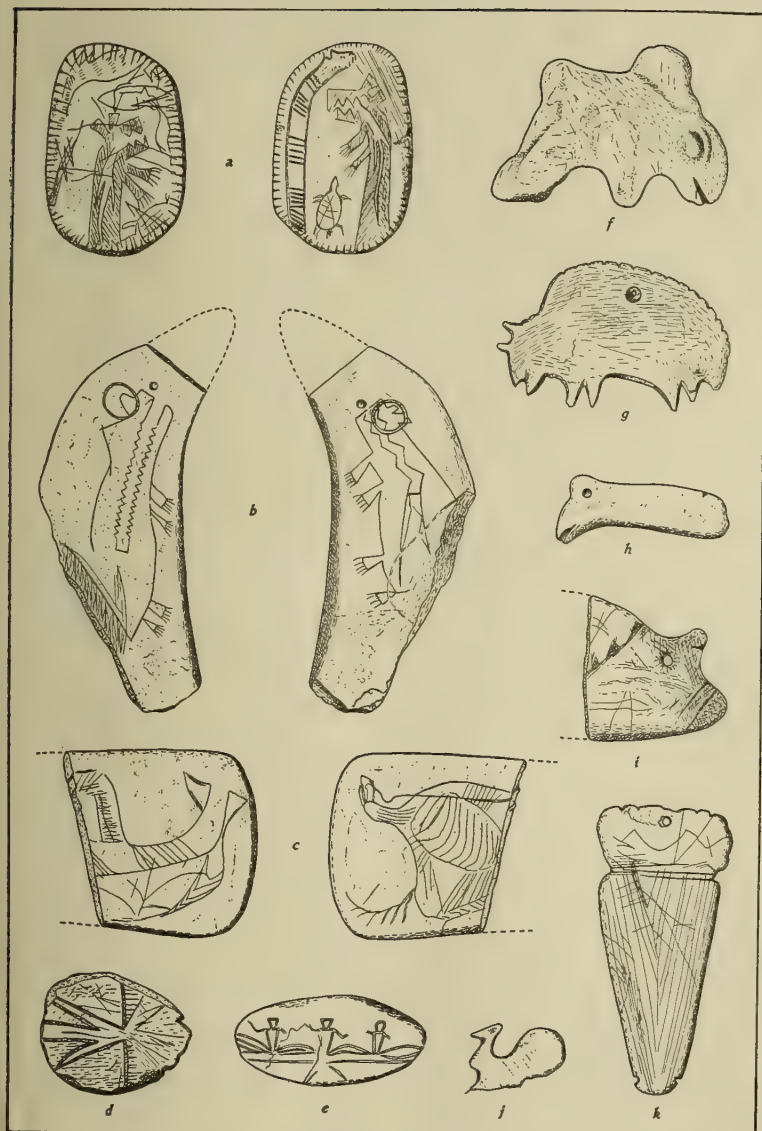
Tobacco pipe of clay-stone, representing an owl. Found with a skeleton in Trench I in 1911. (About $\frac{1}{2}$.)

Lightning symbols appear upon either side of the specimens figured in i and l. The pipe shown in j, has two horn-like appendages projecting backward from either side of the opening forming the bowl.

The pipe figured in k is made of nearly black serpentine and is highly polished. It is evidently intended to represent the turkey, for the "beard," peculiar to this bird, appears upon the breast. It was taken from a cache-pit by Dr. Metz in 1881.

A fish-shaped pipe of limestone, also found in a cache-pit, is figured in m. It differs from most specimens by having the hole for the reception of the stem at the side.

Two interesting effigy pipes are illustrated in o, p. Apparently swimming birds are represented, both of them being in the position usually taken while oiling the feathers. The first of these is shown with two heads. This was found beside the skull of a skeleton in Trench IV, by Mr. Swanton, as will be seen by referring to plate 3, a. The other is from a cache-pit.



MADISONVILLE SITE

a-c, Pebbles with incised drawings upon both sides; *d, e*, Pebbles with incised drawings; *f, h, i*, Pebbles but slightly modified by art, these are probably fetishes; *g, k*, Pendants of lignite, the first of these represents a buffalo; *j*, Effigy of a turkey cut from antler. (About $\frac{1}{2}$.)

The specimen figured in q, of limestone, was taken from near the head of a skeleton by Professor Putnam in 1882.

The largest and finest pipe obtained during the explorations is illustrated in figure 5. It represents an owl, and was found with skeleton 9 in Trench I, by B. W. Merwin in 1911. It measures about five and three-fourths inches in length, including tail, which has been broken off. The material is a variety of fire-clay or clay-stone of mottled gray color. It is well modeled and carefully finished. The hole for the stem is in the center of the back, while the cavity for the tobacco is in the neck.

Incised Drawings, etc. If the art of the occupants of the Madisonville site is indicated at all clearly by the few crude drawings and sculptures which were recovered, it seems to have reached about the same stage of development as that of the surrounding Algonquian tribes at the time of their first intercourse with Europeans. It was far inferior to the art of the builders of the great earthworks, who preceded them in southern Ohio.

It is highly probable that the painted designs and quillwork patterns of this people on dressed skin and other perishable objects were of a higher grade than one would be led to believe, judging from the crude efforts illustrated on plate 20.

A thin waterworn pebble of lignite, from a cache-pit, with designs upon either side is shown in a. The edges are ornamented by a series of short lines, and upon one side is incised the picture of a horned serpent, a small quadruped, and what appears to be a mythical monster with open mouth and prominent teeth. The characteristic triple eye design occurring on certain shell gorgets and pipes from this site is also shown in the figure, which makes it probable that the creature represented belonged to the mythology of the people. A representation of this same being is also etched upon the opposite side of the pebble.

The same figure, more crudely drawn, is scratched upon either side of the flat claystone pebble shown in b. Subsequently, probably on account of the resemblance of the pebble to the outline of a bird's head, two large circles were cut on opposite sides to represent the eyes of the bird, and in front of each a shallow hole was drilled to indicate the nostrils.

It is a fact well known to ethnologists that natural objects resembling human or animal forms, or any of their parts, were sup-

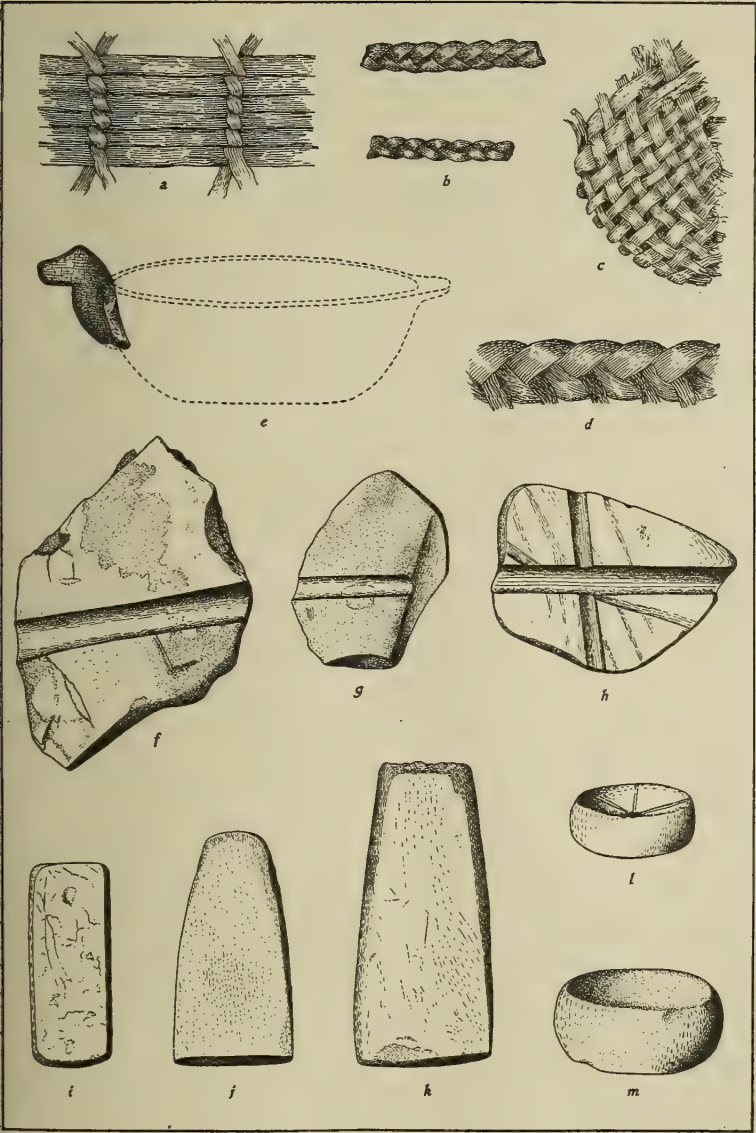
posed to possess supernatural powers, and were often used as fetishes. A number of such objects were recovered. In most instances their forms were but slightly modified by the Indians. Usually only a mouth or eyes were added to accentuate the realistic appearance.

In addition to the one above referred to, (b), good examples are illustrated on the plate. In the head shown in h, the pebble is unmodified with the exception of a hole for the eye upon either side, the groove for the mouth, a small notch near the end opposite the head, and the beginning of a perforation for suspension.

The form of the clay concretion (f), is also wholly natural, with the exception of the groove for the mouth which has been cut upon both sides. In the fragment of another clay object, which somewhat resembles the human profile (i), the grooves which may represent the mouth, the scratches near the nose and surrounding the eye, and the etched band on the forehead, are artificial. The rest of the specimen, including the perforation, is natural. Other fetishes of this class, cut from diseased antler tips, are figured on plate 17, e.

The small object shown in g, plate 15, is made of bone and is carefully polished. While it resembles some of the fetishes above referred to, it is probably an implement, consisting of a handle terminating in what was evidently intended to represent the head of a bird. The eyes and the opening of the beak are indicated on either side by a dot and an incised line. A beautifully finished tool, similar in form but much larger, which was obtained from a Mandan site in North Dakota, is illustrated in the third volume of the *Peabody Museum Papers*, page 172. One end was in the form of a "crane's head." This portion was serrated along its upper and lower edges, and the implement quite closely resembles a modeler's tool.

The lignite pendant illustrated in g, plate 20, is probably intended to represent a buffalo. Another, of the same material, showing a simple arrangement of incised lines is figured in k. These two were found by Mr. Swanton during general excavations. A figure cut from antler and resembling a turkey cock with its tail spread, appears in j. A part of a nearly black pebble, illustrated in c, has an etched design upon either side. The drawing at the right seems to represent a quadruped, with the head, tail,



MADISONVILLE SITE

a-d, Charred fragments of bags made of bast; *e*, Charred fragment of wooden bowl; *f-h*, Grooved stone finishers; *i-k*, Stone tablets, use unknown; *l, m*, Discoidal stones. (About $\frac{1}{2}$.)

and the greater part of the body appearing on the fragment. The lower portion is missing. Upon the opposite side is etched what appears to be a bird.

A number of small stones, bearing designs which are to us unintelligible, were found in the general refuse; one is shown in d.

The scene represented on the small pebble illustrated in e, shows the upper portion of three human figures with arms extended and wave-like lines below. These lines may indicate water.

The objects illustrated upon this plate are from cache-pits or were found while excavating. None of them are from graves.

Textile Fabrics and Wooden Utensils. Almost nothing remains to indicate the types of basketry, bags and other fabrics, or the various forms of wooden objects used by the inhabitants of this site. Pottery, stone and bone implements formed, of course, but a very small portion of the artifacts of the people.

The few charred remains of the more perishable objects, however, indicate that their bags and wooden utensils, and probably their basketry also, were similar to those of the surrounding country.

On plate 21, d, is illustrated a charred fragment of the border of a bag made of coarse bast, which was taken from a cache-pit containing about three bushels of carbonized corn. Another fragment of probably the same bag, is shown in a. The latter drawing is from a sketch made by Dr. Metz, at the time the fragment was uncovered. In removing the "matting," however, it crumbled to pieces. Dr. Metz's sketch, together with the fragment of the border (d), show that the bag was technically identical with others of coarse bast, which were, until very recently, common among the Ojibwa and the people of the region south of the Great Lakes.

In the collections of the Museum is a bag of the same weave and probably of the same material, obtained from the Sauk and Fox. It is strongly made of coarse bast and is well adapted for holding and transporting shelled corn.

Fragments of the bag found in the pit by Dr. Metz were mixed with the charred corn, and at least a portion of this corn had doubtless been deposited in the bag.

A lower corner of another bag of bast is illustrated in c. This was found with charred corn in a pit by Mr. Swanton. In the Ojibwa exhibit in the Peabody Museum is a bag of the same

technic and material, which has the border at the opening also finished as in d.

The fragments of braided cordage shown in b were found with charred material in another pit. They are probably the remains of cords for closing the mouths of bags similar to those above described.

In common with most of the tribes of the eastern section of the United States, this people undoubtedly were well supplied with wooden bowls and platters. Only one small carbonized fragment, however, was brought to light during the Museum's explorations. This was taken from a cache-pit near the southern edge of Trench K by B. W. Merwin, and is figured in e. The broken lines show the approximate form of the bowl.

Wooden bowls and platters, especially among the Algonquian tribes, were of excellent design and workmanship. They were usually made of the knotty or burly portions of maple or other hard wood, and the rim was often ornamented with a representation of the head of a bird or animal after the manner shown in the illustration.¹

Pottery. The pottery recovered from this site shows a considerable variety in form, as will be seen by referring to the plates. Most of the vessels are of the cooking-pot type, although a few food bowls were found, and also several erratic forms which do not seem to belong to either of these groups. The ware is as a rule well-made and fairly durable. The material is the clay of the region tempered principally with ground or pulverized union shells. Approximately half of the vessels show the impression of cord-wrapped paddles used in their making. The texture of the ware is well brought out in the photographs, plate 22. Nearly all of the pots are furnished with ears, usually four but sometimes two only, which were used for holding in place bands or thongs to which suspending cords were attached. It does not seem to have been customary to fasten suspending cords directly to the ears, although this may have been done occasionally. To facilitate the carrying of the smaller pots of this type, the Mandan sometimes tied a thong around the neck of the vessel, passing it through the ears, and a single looped handle a few inches long was made by again

¹ For examples of other bowls, see Willoughby, *Wooden Bowls of the Algonquian Indians*, *American Anthropologist*, vol. x, p. 423, 1908.



MADISONVILLE SITE

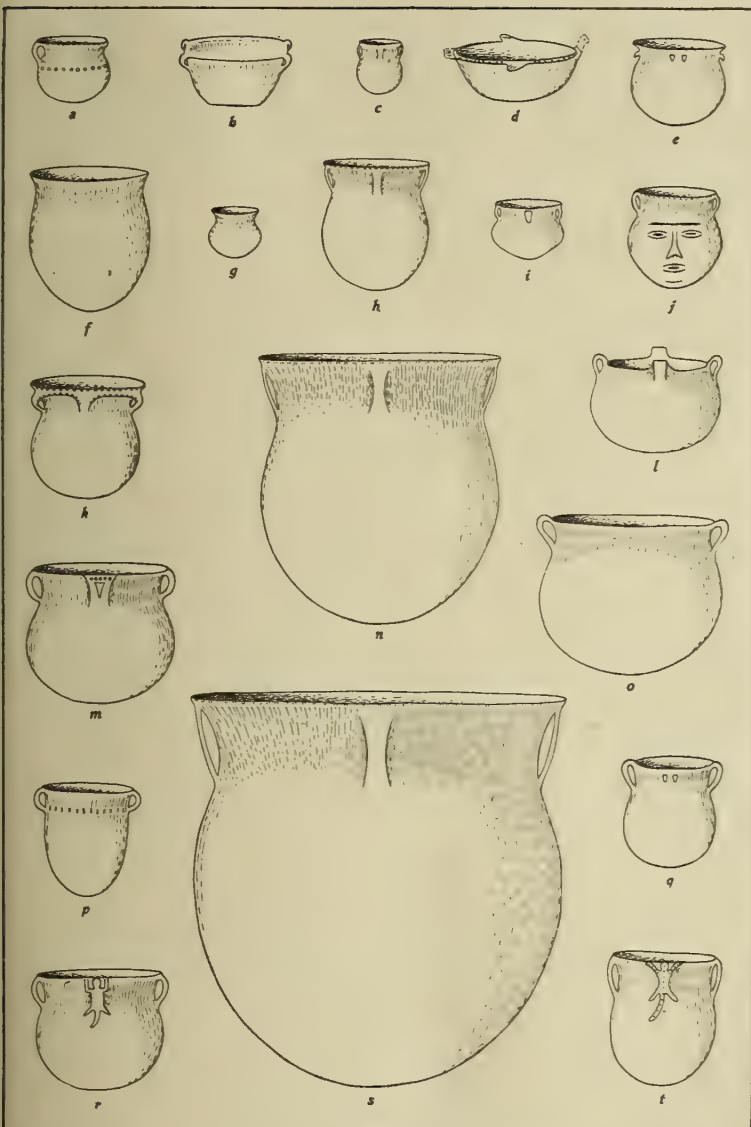
Typical pottery vessels from graves. (About $\frac{1}{2}$.)

tying the ends of the thong together. Most of the smaller unbroken pots, holding approximately a pint to a gallon, such as are illustrated on plate 23, with the exception of n, and s, are from graves. They were more commonly placed near the head, in the manner illustrated in plates 3 and 4. See also table on page 16. These pots evidently contained food, in some cases probably samp or maize porridge or a similar substance, shown by a deposit on the inner side of many of the vessels, which marked the original level of the semi-liquid contents. As the water slowly evaporated, the bran or other material near the surface was deposited on the inner side of the pot in a narrow horizontal band or line more clearly marked at the top, which, although not very conspicuous, can be easily traced. Many of the vessels contained a single valve of a unio shell which served as a spoon, and sometimes bones of food animals were also noted.

The majority of the vessels found with skeletons were of the style shown in plate 23, h, i. They varied considerably in size and contour, but were usually furnished with four ears; and were, as a rule, without ornamentation with the exception of slight indentations around the rim and the usual cord-wrapped paddle marks on the body of the pot as shown in plate 22. Few vessels without ears were taken from graves; two are illustrated in f, g, plate 23. Cups with a single handle or ear (a) are rare. Quite a number of pots having two plain ears and two in the form of small quadrupeds with the usual passage between the body of the animal and the neck of the vessel, as shown in r, t, accompanied skeletons. In a few instances a pair of lugs curving downward replace the animals on either side (q), and in one example four pairs of lugs were substituted for the usual looped ears as shown in e. These of course were intended to assist in holding the neck band in place. Bowls in the form of birds or quadrupeds were uncommon. Besides the one illustrated in d, fragments of two or three similar ones were found in the refuse, also several heads broken from bowls of the same general kind, including one which may have been intended for that of a dog. The vessel with the human face modeled upon one side, shown in j, plate 23, is the only example of this type obtained. This was found near the head of a skeleton. But one vessel modeled to represent a pot set within another (plate 24, j) was obtained during the exploration by the Museum. One or two

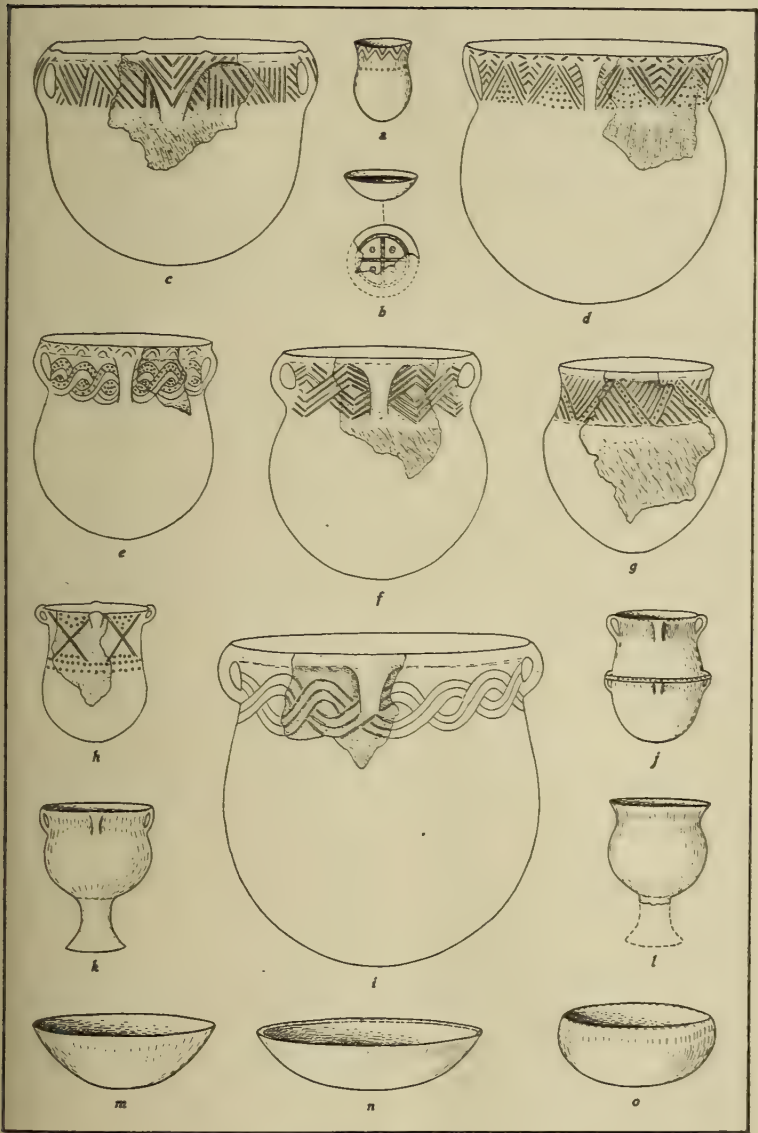
others, however, were previously taken from this cemetery. On plate 24, k, and l, are figured two curious vessels with solid bases, one of which has been broken off. These are now in the collection of the Cincinnati Museum. The unbroken specimen was found with a skeleton by Dr. Metz many years ago. The base of a third vessel of this type was obtained during explorations of the Museum. Food bowls of forms illustrated in m, n, and o, were not plentiful. Fragments were found in the cache-pits and during general excavations. Those illustrated are restored from large pieces. The only example of a vessel with painted decoration known to the writer from this site is in the Cincinnati Museum. It is illustrated in b. The design is in black on an unpainted ground and represents the primitive cosmic symbol, the cross within a circle, and a dot for each quarter. It is highly probable that this was a ceremonial bowl. Fragments of cooking pots of the larger sizes were found throughout the cache-pits and in the general refuse. One of the largest, measuring nineteen inches in height and about the same in diameter, restored from fragments, is shown on plate 23, s. These large pots were quite common, judging from the numerous sherds. They were not found with burials, as they were evidently not intended for individual food containers, but were used in preparing food for families or a considerable number of individuals. Many of these larger vessels were ornamented with incised decoration applied principally to the neck. The prevailing designs are variations of the guilloche as indicated in plate 24, e, f, i, but many of the patterns consist of a herring-bone arrangement of straight lines or lines and dots as in c, d, g. In some instances the ears were quite elaborately decorated with straight or curved lines. A few miniature cups were found and a small number of little clay effigies of animals all crudely executed, probably the work of children or made by their elders for toys.

The large number of fragments of vessels of all sizes found in the cache-pits, refuse piles, and during general excavations, indicate the abundance of vessels in use, as well as the long occupation of the ground. Perhaps no group of artifacts from this site is more distinctive than the pottery. A comparison with that from other village sites in the Little Miami Valley, however, notably those near Newtown, and certain others at or near Fort Ancient, as well as from such widely separated localities as the Feurt site near



MADISONVILLE SITE

With the exception of the two largest pots (*n* and *s*) which are restored from fragments found in cache-pits, the specimens here shown are typical vessels from graves. ($\frac{1}{10}$.)



MADISONVILLE SITE

a, j, k, l, Pottery vessels from graves; b, Small bowl with primitive cosmic symbol in black; c-i, Pots with incised decorations, restored from large fragments from cache-pits; m, n, o, Bowls restored from large fragments; b, k, l, Cincinnati Museum. ($\frac{1}{10}$.)

Portsmouth and the Gartner site near Chillicothe in the Scioto Valley, show that it all belongs to one group. This is true also of other forms of artifacts in general. Madisonville, however, seems to have been the most important center yet known of this culture, and the pottery in general had reached a somewhat higher degree of technical excellence here than in the other localities noted.

THE SKELETAL REMAINS

The Collection in General. In the various collections of human remains gathered from the cemetery near Madisonville by the excavators of different periods, and deposited in the Peabody Museum, 86 crania were found which belonged to full-grown individuals and were in condition to be measured. Two of these were of doubtful sex, and for this reason the measurements have not been included in the tables. In the other cases sexual differentiation according to the usual criteria was not difficult. The majority of the better preserved crania are separated from their bones because of lack of proper storage facilities in the Museum, and so, in many instances, the bones and skull of the same individual were sexed independently. Upon comparison of the separately sexed skulls and bones agreement as to the sex assigned by the observer in the two instances was found in every case except one, where there is unquestionably a mixture of the bones of two individuals of different sexes under the same catalogue number. The skeletal material was catalogued according to graves and in some instances the graves contained mixed burials.

It was not possible to examine and make a full report upon all of the skeletal material from Madisonville, and the total number of individuals represented in the material studied is 217. Of these 111 were adult males, 60 adult females, 16 adults of undetermined sex, 22 children and adolescents, and 8 infants. Many of the skulls measured were sent in from the early excavations by Metz and are unaccompanied by their bones. Most of the bones studied are from skeletons of which the skulls are fragmentary. Apart from the crania, the bones of 112 skeletons were studied, including 90 adults, but only 17 of 86 crania measured belong with these adult skeletons of which the bones were studied.

About half of the total number of crania measured, including the majority of the best preserved, are from the early excavations

of Dr. Metz and Professor Putnam. Of the remainder about half are from J. R. Swanton's excavations and half from R. E. Merwin's. Most of the bones studied are from the excavations of Mr. Swanton in 1897.

The measurements, with the exception of the cranial capacities, were taken by the writer with accurate instruments, and, unless otherwise stated, conform to the national agreements of Monaco and Geneva. The cranial capacities were measured by Mr. George Schwab, Associate in African Archaeology and Ethnology in the Peabody Museum, according to the method of Dr. Hrdlička, and under the supervision of the writer. Mr. Schwab also rendered valuable assistance in the preparation of this paper by recording the measurements and observations.

The observations conform to the system devised by Dr. Ales Hrdlička, and in use in the Department of Physical Anthropology in the United States National Museum.

For comparative material in the study of the crania an unpublished doctoral dissertation by the late R. G. Fuller, on the crania from the Tennessee Stone Graves in the Peabody Museum, has been utilized. This study of a series of 188 crania from Tennessee was prepared by Mr. Fuller under the direction of the writer and according to the methods in use in the Peabody Museum and in the National Museum.

Frequent reference has been made also to an article by F. W. Langdon, M.D., entitled *The Madisonville Prehistoric Cemetery Anthropological Notes*, Journal of the Cincinnati Society of Natural History, vol. iv, no. 3, October, 1881, pp. 237-257. This article includes an examination of 83 crania from the early excavations in the Madisonville cemetery and notes on the pathology of the bones.

Constant use has been made of two studies in the physical anthropology of the American Indians by Dr. Ales Hrdlička: *Report on an Additional Collection of Skeletal Remains, from Arkansas and Louisiana*, a reprint from the Journal of the Academy of Natural Sciences of Philadelphia, vol. xiv, 1909; and *Physical Anthropology of the Lenape or Delawareans, and of the Eastern Indians in General*, Bulletin 62, Bureau of American Ethnology, 1916.

Cranial Deformation.

OCCIPITAL DEFORMATION					
	None	Slight	Medium	Pronounced	Total
Males: number	14	34	1	4	53
" per cent	26.41	64.14	1.88	7.54	73.5
Females: number	5	20	2	2	29
" per cent	17.25	68.96	6.89	6.89	82.7

This series includes comparatively few skulls with pronounced cranial deformation, as the table above shows. A considerable proportion (26 per cent in males and 17 per cent in females), shows no artificial deformation whatever, and in the majority of cases deformation, where present, is very slight. The total percentage of male crania exhibiting some degree of deformation is 73.5, while the corresponding figure in the case of the females is 82.7. In 115 male crania from the Tennessee Stone Graves, Fuller found 63 or 54.7 per cent with very pronounced occipital flattening, and a series of 70 female crania from the same graves included 34.2 per cent of markedly deformed crania. This does not take into consideration the slight degrees of deformation.

Deformation is of the occipital type only — a fact noted by Langdon also — and is probably due to a slight cradle-board flattening. It is perhaps of interest to note in this connection that no cases were observed in this series in which the auditory meatus seemed compressed in an antero-posterior direction, nor were bony exostoses found in the meatus in any case, although they occur in 13 per cent of Fuller's Tennessee series.

It is of some importance in connection with the utilization of artificially deformed crania for purposes of craniometric study to attempt to ascertain to what extent the original form has been altered, since it is obvious that very radical changes in the head-form brought about by this cause render the study of the proportions of the cranial vault useless, unless some method of correcting for deformation is available. No exact method exists, and with a good deal of reason some anthropologists exclude from their series for measurement all crania showing pronounced artificial deformation. In the case of American Indian crania the debarring of specimens showing artificial deformation would mean the exclusion of some of the largest and most important groups.

In the present investigation an attempt has been made to ascertain the differences in cranial indices between skulls showing no deformation and skulls showing medium or pronounced deformation.

Cranial Vault Indices.

CRANIAL INDICES OF UNDEFORMED CRANIA

	Dolicho.	Meso.	Brachy.	Total	Min.	Max.	Mean
Males: number	1	7	6	14	74.46	85.80	79.61
“ per cent.	7.14	50.0	42.85				
Females: number	0	2	3	5	77.09	83.04	79.78

CRANIAL INDICES OF CRANIA WITH MEDIUM OR PRONOUNCED DEFORMATION

	Dolicho.	Meso.	Brachy.	Total	Min.	Max.	Mean
Males: number	0	0	5	5	82.49	90.9	86.72
Females: number	0	0	4	4	84.21	92.55	87.56

CRANIAL INDICES OF CRANIA WITH SLIGHT DEFORMATION

	Dolicho.	Meso.	Brachy.	Total	Min.	Max.	Mean
Males: Number	0	7	26	33	76.24	92.31	83.03
“ per cent.	0	21.21	78.78				
Females: number	1 ¹	1	18	20	70.39 ¹	88.62	84.25
“ per cent.	5.0	5.0	90.0				

CRANIAL INDICES OF ALL CRANIA

	Dolicho.	Meso.	Brachy.	Total	Min.	Max.
Males: number	1	14	37	52	74.46	92.31
“ per cent.	1.92	26.92	71.15			
Females: number	1	3	25	29	70.39	92.55
“ per cent.	3.44	10.34	86.20			
Both sexes: number	2	17	62	81	70.39	92.55
“ per cent.	2.47	20.98	76.54			

It is apparent from the consideration of the tables given above that the nine crania of our series exhibiting medium or pronounced artificial deformation are all brachycephalic skulls, and all extremely brachycephalic, with the exception of two male skulls, which have indices of 82.58 and 82.49 respectively. If these last had not been artificially deformed they might have been mesocephalic, but not dolichocephalic. The others belong without question of deformation in the brachycephalic class. On the other hand, of 19 undeformed crania 9 are brachycephalic, so that it ap-

¹ This cranium showed a slight flattening in the lambdoid region which had the effect of increasing its length.

pears that a minimum of about half of our series would be brachycephalic if all were undeformed. But the high percentage of brachycephaly in the largest sub-group, that of crania with slight deformation (78.78 per cent of males and 90 per cent of females), indicates that a higher original proportion of brachycephaly than 50 per cent is to be expected in the whole series. For in the sub-group with slight deformation there has probably been very little alteration in the indices through this cause, and many of the crania exhibit high degrees of brachycephaly. The writer is inclined to believe therefore that the percentages given for brachycephaly for the whole series are only slightly in excess of the figure to be expected if there had been no deformation.

Of 17 crania yielding mesocephalic indices, 9 are undeformed and 8 show slight occipital deformation. The slight occipital deformation has perhaps shifted some of these from the dolichocephalic class to the mesocephalic class. Of the 7 mesocephalic male skulls with slight occipital deformation, 4 have indices of 76, one of 77, and 2 of 78. Of the undeformed crania, 50 per cent are mesocephalic, and of the slightly deformed 21.21 per cent. When we consider the extreme rarity of dolichocephaly in the undeformed sub-group (one case only), it will appear that the decrease in mesocephaly in the slightly deformed sub-group is in accordance with what we should be lead to expect if more crania were shifted from the mesocephalic to the brachycephalic class through deformation than from the dolichocephalic to the mesocephalic class.

In order to check still further the effect of unintentional artificial deformation on cranial form, the writer has made use of the series in the Peabody Museum from the Tennessee Stone Graves, measured by R. G. Fuller, to show the cranial indices in the undeformed sub-group, the deformed sub-group, and in both combined. In this series occipital deformation is much more pronounced, and Fuller states that a slight degree of frontal deformation may often be observed.

CRANIAL INDICES OF UNDEFORMED TENNESSEE CRANIA

	Dolicho.	Meso.	Brachy.	Total	Min.	Max.
Males: number	4	15	24	43	70	92
“ per cent	9.3	34.88	55.81			
Females: number	1	5	22	28	74	93
“ per cent	3.57	17.85	78.57			

CRANIAL INDICES OF DEFORMED TENNESSEE CRANIA

	Dolicho.	Meso.	Brachy.	Total	Min.	Max.
Males: number.....	0	1	62	63	79	105
" per cent.....	0	1.58	98.41			
Females: number.....	0	0	36	36	81	106
" per cent.....	0	0	100.00			

CRANIAL INDICES OF ALL TENNESSEE CRANIA

	Dolicho.	Meso.	Brachy.	Total	Min.	Max.
Males: number ¹	5	18	92	115	70	105
" per cent.....	4.34	15.65	80.0			
Females: number ¹	1	6	63	70	74	106
" per cent.....	1.42	8.56	90.0			
Both sexes: number ¹	6	24	155	185	70	106
" per cent.....	3.24	12.97	83.78			

If we compare the above tables with the similar tables for the sub-groups according to deformation in our Madisonville series, it will be observed first of all that the undeformed Tennessee crania include a larger percentage of brachycephals than the corresponding Madisonville sub-group — an excess amounting to about 13 per cent in the males. In the entire series the percentage of brachycephals for both males and females combined is 83.78 against 76.54 in our Madisonville series. The deformed Tennessee crania include no dolichocephals and but one mesocephal, whereas in our series one dolichocephal and 8 mesocephals show slight deformation. As the percentage of mesocephalic crania in the Tennessee series is smaller in the undeformed sub-group than in the corresponding Madisonville sub-group, there were probably fewer Tennessee individuals of hereditarily mesocephalic crania who could be shifted into the brachycephalic class through accidental deformation. This may partly account for the smaller excess in proportions of brachycephals in the entire Tennessee series over that in the entire Madisonville series as compared with the corresponding proportions in the undeformed sub-group. But on the other hand, only 61.6 per cent of the Tennessee series show deformation as against 73.5 in our series. Of the Tennessee brachycephals, 29 per cent show no deformation, against 11 per cent of our brachycephals. This difference may be due to the somewhat more rugged character of the Tennessee crania, which might render

¹ Includes several crania in which measurements were approximate.

them more resistant against deformation; it may be due to the personal equation of the two different observers in recording deformations; it may be due to error incident to the sampling process, since both series are comparatively small, and our entire series includes 81 cranial indices as against 185 in the Tennessee series.

The examination of the Tennessee series confirms our conclusion that accidental occipital deformation affects dolichocephalic crania very little, mesocephalic crania slightly more, and brachycephalic crania most of all.

Assuming artificial deformation to have been caused by pressure of the occiput on a hard cradle board, it seems clear that this cause would naturally affect round-headed infants to a greater extent than long-headed infants, for if the head of the child is free to turn from side to side, the tendency for the dolichocephalic child with the protruding occiput is to rest the head on one side or other rather than on the back. On the other hand, a brachycephalic child with an occiput more or less flat is likely to rest on the back of the head rather than on the side. Again, if the head is fixed so that it must rest on the occiput the greater convexity of the long-headed occiput presents less surface for deformation than the relatively flat occiput of the round head.

On the whole the present writer is inclined to believe that radical changes in head form were not usually brought about by unintentional occipital deformation, but that the most of crania affected thereby were originally brachycephalic or sub-brachycephalic. Some few dolichocephalic crania may have been transformed into mesocephaly; more were probably transferred from the higher grades of mesocephaly to brachycephaly; still more brachycephalic crania were made increasingly so.

It remains to compare the cranial indices in our series with those of the group studied by Langdon, and with other groups. In rearranging his seriations in accordance with the modern divisions of the index, only crania which have been sexed have been included.

CRANIAL INDICES OF MADISONVILLE CRANIA (LANGDON)

	Dolicho.	Meso.	Brachy.	Total
Males: number	1	12	23	36
" per cent	2.77	33.33	63.88	
Females: number	2	6	14	22
" per cent	9.09	27.27	63.63	

As compared with our series, that of Langdon shows an excess of mesocephalic crania (33.33 per cent against 26.92 in males) and an excess of brachycephalic crania. These differences are even more pronounced in the case of the females (10.34 per cent of mesocephalic crania in our series as against 27.27 in his series). That these differences, however, are due to the shortness of the series may be seen from the results of including in Langdon's series 14 other crania which he was unable to sex. The following table shows the fundamental similarity:

CRANIAL INDICES OF MADISONVILLE CRANIA (MALE AND FEMALE)

	Dolicho.	Meso.	Brachy.	Total
Peabody Museum: number	2	17	62	81
" " per cent	2.47	20.98	76.54	
Langdon series: number	5	15	52	72
" " per cent	6.94	20.83	72.22	

The average length (diameter antero-posterior maximum) of 52 male crania of our Madisonville series is 177.4 mm. and the range from 161–195 mm. The mean length of 29 female crania is 169 mm. and the range from 161–179 mm.

The average width (diameter lateral maximum) of males is 146.1 mm. and the range 133–160 mm. In the females the average width is 141.7 mm. and the range 126–150 mm.

LENGTH-HEIGHT INDEX

	Chamaecephalic x-69.9	Orthocephalic 70-74.9	Hypsicephalic 75-x	Total
Peabody Museum series:				
Males: number	0	10	32	42
" per cent	0	23.81	76.19	
Females: number	0	6	21	27
" per cent	0	23.33	77.77	
Both sexes: number	0	16	53	69
" " per cent	0	23.19	76.81	
Langdon series:				
Both sexes: number	1	2	55	58
" " per cent	1.72	3.44	94.82	

As the series given above includes all crania, deformed and undeformed, it is subject to the same reservations as the cranial index discussed above. It will be noted in the analysis of the above table that there is a considerable discrepancy in results between our



MADISONVILLE SITE

Male cranium, brachycephalic type

Norma lateralis
Norma verticalis

Norma facialis
Norma occipitalis

series and that measured by Langdon in 1879. Our series shows a range of the index from 70 to 83, whereas Langdon's series ranges from 68 to 89. Langdon's series has an excess of hypsicephals amounting to about 18 per cent. This difference is distinctly puzzling in view of the similarity as regards the seriation of the cranial index in the two series. Langdon does not state how he measured cranial height. He may have taken maximum height instead of basion-bregma height. Langdon's series comes from the first year's excavations in the cemetery, whereas the majority of our crania are from later excavations in other portions of the cemetery, but if there had been a marked difference in headform we should have expected it to show in the cranial index.

Of 53 undeformed Tennessee Stone Grave crania of both sexes measured by Fuller, 96.22 per cent were hypsicephalic and 3.77 per cent orthocephalic.

BREADTH-HEIGHT INDEX

	Tapeinocephalic x-91.9	Metriocephalic 92-97.9	Akrocephalic 98-x	Total
Males: number	15	20	7	42
" per cent	35.71	47.62	16.66	
Females: number	10	15	2	27
" per cent	37.03	55.55	7.40	
Both sexes: number	25	35	9	69
" " per cent	36.23	50.72	13.04	

The range in this series is from 82 to 100 in the males and from 86 to 100 in the females. I have not calculated the mean as it is of doubtful significance in so heterogeneous a group of crania. Comparison with the Langdon group of Madisonville crania is omitted because the indices are not given.

From the above table it will be seen that the relative height of this series is somewhat small. In 53 undeformed Tennessee crania of both sexes Fuller found 3.77 per cent tapeinocephalic, 28.30 per cent metriocephalic, and 67.92 per cent akrocephalic. This brings out sharply an important difference in these neighboring groups. The basion-bregma height is absolutely lower in our series (average for males 136.9 mm., females 131.3 mm.; against 144 mm. for males and 139 mm. for females in the Tennessee series).

Cranial Arcs.

CRANIAL ARCS AND CIRCUMFERENCES

	Mean		Range		Number	
	Male	Female	Male	Female	Male	Female
Horizontal circumference:						
Madisonville	513	493	482-540	462-515	44	26
Tennessee (Fuller)	512	481	480-530	462-495	..	..
Nasion-opisthion arc:						
Madisonville	361	345	334-379	328-365	41	21
Tennessee (Fuller)	359	349	331-400	326-368	..	..
Transverse arc:						
Madisonville	316	306	300-350	281-325	42	26
Tennessee (Fuller)	310	302	293-348	292-321	..	..

In the table above the cranial circumferences and arcs of the Madisonville series are compared with those of the Tennessee Stone Grave series measured by Fuller, including in the latter case only undeformed crania. In the case of the horizontal circumference (taken above the brow ridges), the males of the two series show very similar values, while the Madisonville females surpass the Tennessee females in the mean value of the circumference by 12 mm. The mean values of the same measurement for Arkansas and Louisiana series studied by Dr. Hrdlička are as follows: Arkansas males 500, Louisiana males 504; Arkansas females 485, Louisiana females 488.

This measurement and the following were not taken by Langdon on his Madisonville series.

In the case of the nasion-opisthion arc the mean value for Madisonville males again exceeds slightly that of the Tennessee males while the Madisonville females fall below the Tennessee females. The corresponding values in the cases of the Arkansas and Louisiana series are: Arkansas males 352, Louisiana males 355; Arkansas females 342, Louisiana females 348.

The excess of the Madisonville crania over the Tennessee crania in the transverse arc may be due partially to the fact that Fuller measured to the supra-mastoid crest, while the writer measured to porion.

Cranial Capacity.

	Mean	Range	Number
Madisonville series: males.....	1435 cc.	1265-1630 cc.	38
" " females.....	1287	1150-1380	21
Tennessee series (Fuller): males.....	1410	1175-1680	?
" " females.....	1276	1110-1460	?
Arkansas series (Hrdlička): males.....	1455	1310-1670	19
" " " females.....	1255	1140-1395	14

The mean capacities of the series compared above are similar when it is considered that the range is great and the series are comparatively small. Langdon found the mean capacity of 48 Madisonville crania of both sexes to be 1338, but these were measured with dried peas and the writer ascertained by experimentation that this method yields results 50 cc. below the correct capacity of a bronze control skull. If we then add 50 cc. to Langdon's mean we find that it corresponds closely enough with the mean of both sexes in our series, 1382 cc.

Thickness of Left Parietal Above Temporo-parietal Suture. It is very difficult to obtain accurate results in this measurement. In the crania of 46 Madisonville males the mean value of this measurement was 5.8 mm. The range in the males was from 3 mm. to 9 mm. except in the case of one extraordinarily thick cranium which yielded a measurement of 14 mm. on the left parietal just above the temporo-parietal suture. In 28 females the mean thickness at this point was 5.78 mm., very little less than in the males. The range was from 4 mm. to 7 mm. Dr. Hrdlička found the average thickness of the left parietal above the squamous suture in 13 male Arkansas crania 5 mm., and in 9 females 5.3 mm. In another Arkansas group of 22 male crania the average was 5 mm. and in 13 female crania 4.5. In the Louisiana group of 17 males and 18 females the averages were 5.5 mm. and 4.85 mm. respectively.

Minimum Frontal Diameter.

	Mean		Range		Number	
	Males	Females	Males	Females	Males	Females
Madisonville.....	94.97	92.71	87-103	85-103	48	28
Tennessee (Fuller)....	93	90	83-108	82-99	?	?
Louisiana (Hrdlička)...	96	94	85-102	83-99	17	17
Arkansas (Hrdlička)...	96	93	87-102	86-102	13	10

Langdon gives as the mean of this measurement for 69 Madisonville crania of both sexes 93, with a range of 84-107. The corre-

sponding mean in our series is 94.1. The frontal breadth in this series is therefore rather small, though it exceeds that of the Tennessee Stone Grave group.

Facial Index.

UPPER FACIAL INDEX

	Hypereuryene x-44.9	Euryene 45-49.8	Mesene 50-54.9	Leptene 55-x	Total
Males: number.....	1	6	18	2	27
" per cent.....	3.7	22.22	66.66	7.4	
Females: number.....	0	6	6	1	13
" per cent.....	0	46.14	46.14	7.69	

While the majority of the Madisonville crania fall into the mesene group as regards the upper facial index, it will be observed there also exists a strong tendency toward the euryene which is naturally accentuated in the female group. Quite markedly different is the seriation of the upper facial index in the undeformed crania from the Tennessee Stone Graves measured by Fuller. Of 97 males he found 34 per cent leptene, 56.7 per cent mesene, and 9.2 per cent euryene. In 64 Tennessee females the seriation is 34.3 per cent leptene, 54.6 per cent mesene, and 10.9 per cent euryene. In our series bizygomatic diameter in 28 males averages 141 mm., and in 14 females 131.3 mm. Upper facial height averages 72 mm. in 34 males and 66.1 mm. in 18 females.

TOTAL FACIAL INDEX

	Hypereuryprosopic x-79.9	Euryprosopic 80-84.9	Mesoprosopic 85-89.9	Total
Males: number.....	1	12	5	18
" per cent.....	5.55	66.66	27.77	
Females: number.....	0	4	2	6
" per cent.....	0	66.66	33.33	

The number of specimens upon which the measurements necessary for the calculation of the total facial index can be taken is unfortunately small. There is a strong tendency toward euryprosopism in this group, due to large bizygomatic diameters and somewhat small total facial height (averages of 117.9 mm. in 21 males and 110.2 mm. in 7 females). The average total facial index in male crania from Louisiana and Arkansas, as given by Dr. Hrdlička, is between 85 and 86, while the average for the males in our series is about 83. Fuller found the average total facial index

in 92 male crania from the Tennessee Stone Graves 86, and in 59 females 85.2. Fuller found 19.5 of leptoprosopic crania in his males and 10 per cent in his females. The percentages of euryprosopic crania in the Tennessee group were 25 for males and 44 for females. It therefore appears that our Madisonville crania are sharply differentiated from the Tennessee, Arkansas, and Louisiana groups in respect to facial proportions.

Mean Orbital Index.

	Chamaeconch x-82.8	Mesoconch 83-88.9	Hypsiconch 89-x	Total
Males: number.....	20	13	3	36
“ per cent.....	55.55	36.11	8.33	
Females: number.....	12	7	1	20
“ per cent.....	60.0	35.0	5.0	

The orbital index is extremely variable. The mean index of the two orbits ranges in the males from 67 to 101, and in the females from 71 to 90. Often the measurements of the two orbits differ considerably and in such cases the index of the left orbit is usually higher, a fact previously observed by Dr. Hrdlička in regard to the orbits of crania of Indians from Louisiana and Arkansas. In the Tennessee Stone Grave series of 95 males, 33.6 per cent were hypsiconch, 49.4 per cent mesoconch, and 16.8 per cent chamaeconch. Of 69 females 44.9 per cent were hypsiconch, 47.8 per cent mesoconch, and 7.2 per cent chamaeconch. Dr. Hrdlička states that the majority of the Arkansas and Louisiana crania measured by him were megaseme (hypsiconch). It may be observed from the tables above that the Madisonville crania are prevailingly chamaeconch and mesoconch. This is to be expected in view of the large breadth and inconsiderable height of the facial skeleton.

Nasal Index.

	Leptorrhine x-46.9	Mesorrhine 47-50.9	Platyrrhine 51-57.9	Hyperplatyrrhine 58-x	Total
Males: number	7	11	15	2	35
“ per cent	20.0	31.42	42.85	5.71	
Females: number	1	3	10	6	20
“ per cent	5.0	15.0	50.0	30.0	

Almost half of the male crania and four-fifths of the female crania are platyrrhine. This is to be expected in broad, short-faced people, and the sexual difference is usual. In 102 male crania from the Tennessee Stone Graves, Fuller found 45 per cent platyrrhine,

37.3 per cent mesorrhine, and 17.6 per cent leptorrhine. In 73 female crania of the same group the seriation is 63 per cent platyrrhine, 26 per cent mesorrhine, 11 per cent leptorrhine. The Madisonville crania show a higher percentage of platyrrhine indices than the Tennessee group, especially in the females. The mean nasal index in males is 51.6 and in females 55.9. The mean of the Tennessee males is 50.1 and of the Tennessee females 51.5.

Palatal Index (Maxillo-alveolar).

	Dolichuranic x-109.9	Mesuranic 110-114.9	Brachyuranic 115-x	Total
Males: number	2	7	23	32
" per cent	6.25	21.87	71.87	
Females: number	2	4	13	19
" per cent	10.52	21.05	68.42	

The palate in our group is usually brachyuranic with a range in males of 106-129 and a mean of 117.6. The range in the female crania is 108-136 and the mean is 118.7. The means in the Tennessee groups are 122.6 for males and 120.9 for females. Of 84 Tennessee males 89.2 per cent were brachyuranic, 8.3 per cent mesuranic and 2.3 dolichuranic. The corresponding figures for 55 females are: brachyuranic 78.1 per cent, mesuranic 7.2 per cent, dolichuranic 14.5 per cent. Dr. Hrdlička gives as the average palatal index for Louisiana males 116, and for females 122, but the number of specimens included is small. On the whole it may be said that the degree of brachyurany exhibited by the Madisonville group is somewhat less than would be expected in view of the facial proportions and that it is evident that the palates in this group have undergone reduction, which often has the effect of decreasing the index.

Alveolar Index.

	Orthognathous x-97.9	Mesognathous 98-102.9	Prognathous 103-x	Total
Males: number	19	9	0	28
" per cent	67.85	32.14	0	
Females: number	8	8	1	17
" per cent	47.05	47.05	5.88	

While the alveolar index has been discarded by Dr. Hrdlička and other authorities, and is much influenced by the facial length, it is still of interest as an indication of prognathism. According to this index more than two-thirds of our males are orthognathous



MADISONVILLE SITE

Female cranium, brachycephalic type

Norma lateralis

Norma verticalis

Norma facialis

Norma occipitalis

and the rest mesognathous, while the females show a somewhat greater tendency toward mesognathism. In the Tennessee group of 94 males and 56 females the distribution of index classes is as follows: orthognathous, males 70.2 per cent, females 48.2 per cent; mesognathous, males 26.5 per cent, females 41 per cent; prognathous, males 3.2 per cent, females 10.7 per cent. This is quite similar to the Madisonville seriation, but the Tennessee group includes a few more prognathous skulls.

Angles Relating to Prognathism. The facial angle according to Rivet and Hrdlička, included between nasion, alveon, and basion, and measured according to the direct or graphic method, gives an average of 73.1° in 28 males and 72.1° in 17 females. This puts both sexes in the orthognathous group according to Rivet's division of the index which marks the lower limit of that group at 73. The range in the males was from 68° to 79° and in the females from 67.5° to 80° . Dr. Hrdlička found an average of 73° in Munsee or Lenape males and 74° in the females of that group. The following is the seriation of the index.

NASO-ALVEOLO-BASILAR ANGLE

	Prognathous x-59.9	Mesognathous 70-72.9	Orthognathous 73-x	Total
Males: number	4	6	18	28
" per cent	14.28	21.42	64.28	
Females: number	1	9	7	17
" per cent	5.88	52.94	41.17	

If we compare the angle with the results of the alveolar index given above we find that the classification according to the angle removes 4 male crania from the mesognathous to the prognathous class and one orthognathous cranium into the mesognathous class. In the case of the females it changes one cranium from orthognathous to mesognathous. This is a better indication of prognathism than the alveolar index.

Foramen Magnum. The mean diameter of the foramen magnum in 36 male Madisonville crania is 32.8 mm. and in 22 female crania 31.8 mm. This is decidedly below the average for Indian males as recorded by Dr. Hrdlička, but in the case of the females there is a substantial agreement. The following figures are of interest by way of comparison: Munsee, 7 males, 35 mm., 8 females, 32 mm.; Louisiana, 10 males, 34.5 mm., 14 females, 31.8 mm.;

Arkansas, 22 males, 33 mm., 16 females, 31.4 mm. It remains to be seen whether this ratio has any particular significance in relation to stature or other bodily characters.

Lower Jaw.

	Males		Females	
	Number of specimens	Average	Number of specimens	Average
Height at symphysis	25	36.5	9	32.4
Minimum breadth of ramus . . .	30	35.5	9	34.2
Bicondylar width	22	129.0	7	122.7
Condylar-symphysial length . . .	24	104.6	7	104.5
Bigonial diameter	24	103.4	8	99.1
Mean angle	25	125.4	7	126.4

The dimensions of the lower jaws in this series are moderate. The mandibles are especially broad in proportion to their length. The female jaws seem relatively longer than the male but this is possibly due to the shortness of the female series. The mean angle of the ascending rami is unusually high in the male group, but otherwise the measurements do not diverge markedly from those observed in the case of other Indian crania.

Frontal Region.

HEIGHT

	Very low	Low	Medium	High	Very high	Total
Males: number	2	18	30	2	1	53
" per cent	3.75	34.0	56.6	3.75	1.9	
Females: number	1	12	12	6	0	31
" per cent	3.2	38.7	38.7	19.3	0	
Doubtful: number	0	1	2	0	0	3

BREADTH

	Narrow	Medium	Broad	Very broad	Total
Males: number	13	27	10	3	53
" per cent	24.5	51.0	18.9	5.6	
Females: number	6	17	4	4	31
" per cent	19.3	54.9	12.9	12.9	
Doubtful: number	0	1	2	0	3

SLOPE

	Bulging	Submedium	Medium	Receding	Very receding	Total
Males: number	2	4	37	7	3	53
" per cent	3.7	7.5	70.0	13.0	5.6	
Females: number	7	0	20	4	0	31
" per cent	22.6	0	64.5	12.9	0	
Doubtful: number	0	0	3	0	0	3

An analysis of the above tabulations of observed characters in the frontal region of the crania shows that the majority of males (56.6 per cent) had brows of medium height, while a considerable proportion of the remainder (34 per cent) had low foreheads. Only a few crania exhibited high frontals, or very low frontals. In comparison with the males the females show a lesser proportion of frontals of medium height and a decided increase in the numbers of skulls with high frontals (19.3 per cent).

In the matter of frontal breadth, as observed in relation to height and slope, about one half of the male skulls are medium and the other half almost equally divided between narrow and broad. The females show a similar distribution, except for a somewhat larger proportion of relatively very broad frontals.

In the large majority of the male skulls the slope of the frontal bone is medium (70 per cent). The remainder show more with receding frontals than with steep or bulging frontals. The female crania differ from the males in the high percentage of bulging frontals (22.6 per cent). This is, of course, a common sex difference.

Sagittal Region.

BREADTH					
	Submedium	Medium	Broad	Very broad	Total
Males: number	3	26	15	9	53
" per cent.	5.6	49.0	28.5	17.3	
Females: number	2	15	11	3	31
" per cent.	6.5	48.4	35.5	9.6	
Doubtful: number	0	2	1	0	3

ELEVATION						
	Absent	Submedium	Medium	Marked	Very marked	Total
Males: number	10	19	18	4	2	53
" per cent.	18.9	36.0	34.0	7.5	5.6	
Females: number	7	14	9	1	0	31
" per cent.	22.6	45.1	29.0	3.2	0	
Doubtful: number	1	0	2	0	0	3

The tables above clearly show a predominance of medium and broad sagittal regions both in males and in females, with a somewhat larger proportion of the broad categories in the latter sex. A large majority of the male crania show a varying development of the sagittal elevation, but it is very pronounced in a few cases only. Naturally the females show a lesser development of this character.

In 9 male crania, or 17 per cent, a slight post-coronoid depression was observed. This character also was present in a slight degree in 13 female crania, and markedly in one female cranium, — a total of 45.2 per cent. This again is a sexual difference of common observation.

Temporal Region.

	Flat or depressed	Medium	Bulging	Total
Males: number.....	19	18	16	53
“ per cent.....	36.0	34.0	30.0	
Females: number.....	11	10	10	31
“ per cent.....	35.5	32.2	32.2	
Doubtful: number.....	1	1	1	3

The table above shows an almost equal distribution of flat, medium, and bulging temporal regions in both sexes. A pronounced depression of the wing of the sphenoid is very common in this series.

Occipital Region.

	Flat or steep	Medium convex	Protuberant	Occipital torus	Total
Males: number....	38	14	1	16	53
“ per cent....	71.7	26.4	1.9	30.0	
Females: number..	21	8	2	1	31
“ per cent..	67.7	25.8	6.5	3.2	
Doubtful: number.	2	1	0	1	3

The high percentage of flat occipital regions in this series, as shown in the table above, is partially due to artificial occipital deformation, but in a greater degree to the natural shape of the skull. The percentage of male crania exhibiting flat occipital regions is 71.7, while the percentage of all male crania showing occipital deformation is 73.5. On the other hand 67.7 per cent of female crania have flat occiputs, whereas 82.7 per cent show artificial deformation.

A slight occipital torus was observed in 11 male skulls, an occipital torus of medium development in 3 skulls, and of pronounced development in 2 skulls, making a total of 30 per cent of the male crania exhibiting this feature. One female cranium and one cranium of doubtful sex also show a slight development of this feature.

Sutures.

OCCLUSION OF CORONAL, SAGITTAL, AND LAMBDROID

	All open	Beginning in all	Beginning in sagittal	Beginning in coronal
Males: number	26	3	4	0
" per cent.	49.05			
Females: number	25	1	0	2
" per cent.	80.06			
	Beginning in sagittal and lambdoid	Beginning in sagittal and coronal	Beginning at pterion	Advanced in sagittal, others open or beginning
Males: number	3	2	0	8
Females: number	0	1	1	0
	Advanced in sagittal, and in coronal, lambdoid open	Advanced in sagittal, and in lambdoid, coronal open	Advanced in sagittal, coronal, and lambdoid	Total
Males: number	2	2	3	53
Females: number	1	0	0	31

As may be seen from the above tabulations, about half of the male crania in our series and four-fifths of the female crania showed no external traces of obliteration of the sutures. Contrary to what has usually been observed in the case of American crania, points of obliteration appear first in the sagittal suture and obliteration proceeds more rapidly in this suture. Hrdlička observed in his Arkansas and Louisiana series that synostosis began dorsally in the coronal suture, and Fuller makes a similar statement in regard to his Tennessee Stone Grave series. The difference may be due, on the one hand, to the less pronounced occipital deformation of the Madisonville series, or, on the other, to an error consequent upon the small number of crania. It is of some interest to note that in two of the female crania synostosis was recorded to have begun in the coronal and in no case in the sagittal, while of the males no example of priority of coronal obliteration was observed.

The form of pterion found in this series is almost invariably the broad H type, but one male cranium and one female cranium exhibited the K or X type.

SERRATION

	Simple	Medium	Complex	?	Total
Males: number	33	18	1	1	53
" per cent	62.23	33.94	1.88	1.88	
Females: number	21	10	0	0	31
" per cent	67.72	32.25	0	0	
Doubtful: number	1	2	0	0	3

As indicated above, the conformation of the sutures in this series of crania is simple in about two-thirds of the cases and of medium complexity in the remainder.

WORMIAN BONES

	?	None	Lambdoid	Temporo-parietal	Temporo-occipital	Others	Total
Males: number	4	11	32	4	13	9	53
" per cent	7.54	20.75	60.37	7.54	24.52	16.98	71.69
Females: number	0	13	15	0	7	2	31
" per cent	0	41.93	48.38	0	22.58	6.45	58.06
Doubtful: number	0	1	2	0	0	0	3

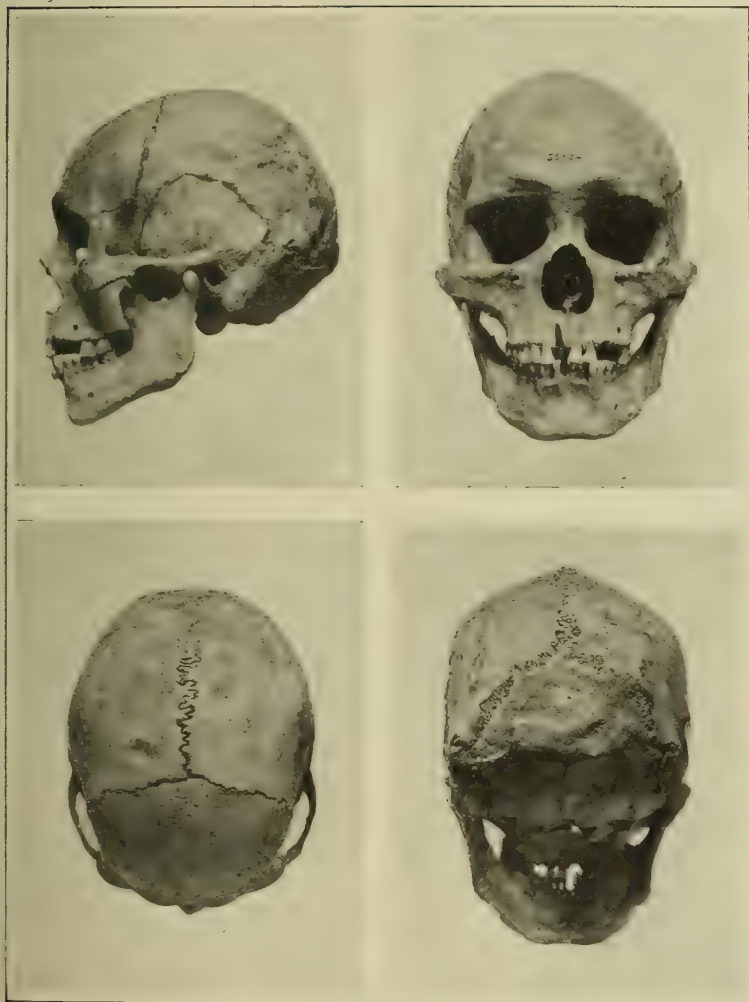
The table above shows that sutural bones occur in 71.69 per cent of the male crania and in 58.06 per cent of the female crania. They are found oftenest in the lambdoid suture and next in the temporo-parietal. Nine epipteric bones were observed in the male crania, one in the coronal suture, one in the sagittal suture, and one os apicum or triangular Wormian bone at lambda. Two of the male crania showed traces of the transverse occipital suture, but it was not complete in either case. There were two epipteric bones among the crania of females and one complete transverse occipital suture. The so-called Inca bone, then, occurs in but one of the 87 crania of our collection, whereas Fuller found it in about 16 per cent of his Tennessee Stone Grave series.

Parietal Foramina.

NUMBER

	None	One	Two	Total
Males: number	24	16	13	53
" per cent	45.26	30.17	24.51	
Females: number	18	7	6	31
" per cent	58.05	22.57	19.35	

Fuller found parietal foramina absent in about 40 per cent of his Tennessee Stone Grave crania. This corresponds fairly closely with the results shown in the above table.



MADISONVILLE SITE

Male cranium, subdolichocephalic type

Norma lateralis

Norma verticalis

Norma facialis

Norma occipitalis

Retro-mastoid Foramina. These are extremely variable in number, size, and position.

Mastoids.

	SIZE				Total
	Submedium	Medium	Large	Very large	
Males: number	22	24	6	1	53
“ per cent	41.49	45.26	11.31	1.88	
Females: number	7	16	7	0	30
“ per cent	23.33	53.33	23.33	0	

The mastoid processes are usually medium or somewhat below medium in size in our Madisonville crania as compared with average Europeans. Fuller found 55 per cent of his Tennessee Stone Grave males with mastoids of medium size, and the remainder equally divided between sub-medium and large. On the whole our series falls somewhat below the Tennessee group in the development of this process. Hrdlička observed in his examination of crania from Arkansas and Louisiana that, while the mastoid processes often showed only a moderate development in the males, in females they frequently exceeded the average determined in the same sex in Whites and in Indians from other regions. He related this development in females to the growth of the sternocleidomastoid muscles favored by the habitual carrying by these women of heavy jars and other burdens. From the table above a similar superiority of mastoid development on the part of females may be observed in our series, and doubtless for the same reason.

Facial Portion.

	SUPRA-ORBITAL RIDGES					Total
	Absent	Submedium	Medium	Large	Very large	
Males: number . .	4	13	25	7	4	53
“ per cent . .	7.54	24.51	47.14	13.16	7.54	
Females: number	11	13	7	0	0	31
“ per cent	35.48	41.93	22.58	0	0	

It is of interest to compare with the above table the results obtained by Fuller in the observation of the same character on 148 male crania and 72 female crania of Tennessee Indians. In the males he found no case in which the brow ridges were undeveloped, 29.1 per cent were of submedium development, 44.6 per cent medium and 26.3 per cent above medium. This shows a distribution of the grades of percentages in various development closely sim-

ilar to that of our series, but the Madisonville crania, on the whole, show more instances of the lesser degrees of development. (Tennessee females: absent 31.9 per cent, submedium 33.3 per cent, medium 29.1 per cent, large 5.5 per cent.)

The types of supra-orbital ridges most commonly found in this series are: (a) in which the ridges are over the median portions of the orbits and limited laterally, (b) in which the lateral portions of the superior orbital margins are thickened to form ridges which are separated from the median ridges, (c) in which the lateral and median ridges are continuous forming a torus from one external angular process to the other. Type *a* is by far the most common in our series. Type *b* is frequently found and type *c* only occasionally.

The orbits in this series present no unusual features. There is considerable variation in the dimensions of right and left orbits in the same individual, as remarked above. Practically all of the orbits are of the oblong shape with rounded corners. In case of the male crania 57.5 per cent of the orbits have their long axes horizontal and 42.5 per cent have long axes inclined downward and outward. In the female crania these figures are 54.54 per cent and 45.54 per cent respectively.

INFRA-ORBITAL SUTURE

	Absent	Right	Left	Both	Total
Males: number	21	2	3	6	32
" per cent	65.62	6.25	9.37	18.75	
Females: number	13	2	3	3	21
" per cent	61.88	4.76	14.28	14.28	

In the above tabulation of the occurrence of the infra-orbital suture the writer has not distinguished between cases in which the suture was present only on the facial aspect and cases in which it was complete on both facial and orbital aspects. Where found it was usually complete. Fuller records the complete absence of this feature in 64 per cent of his male crania from the Tennessee Stone Graves, which agrees closely enough with our figures. But in Tennessee females he finds the suture absent in only 30 per cent of cases as against 61.88 per cent in our series.

NASION DEPRESSION. The nasion depression, which is due in large part to the protuberance of glabella, is very slight or entirely

absent in most of the male skulls in our Madisonville series, and does not occur at all in the crania of females. The type of depressed nasion that is often seen in Australian skulls (*i.e.* where the fronto-nasal suture is not only depressed below the level of the glabella eminence, but is sunken deep below the level of ophryon) does not occur at all in this series.

NASAL BRIDGE

	Breadth				Height				Total
	Submedium	Medium	Broad	?	Low	Medium	High	?	
Males: number	14	24	5	7	11	28	4	7	50
" per cent	28.0	48.0	10.0	14.0	22.0	56.0	8.0	14.0	
Females: number	7	10	5	9	11	10	1	9	31
" per cent	22.57	32.25	16.12	29.03	35.48	32.25	3.22	29.03	

SHAPE OF NASAL BRIDGE

	?	Straight	Convex	Concave	Concavo-convex	Total
Males: number . . .	22	4	8	0	11	55
" per cent . . .	48.84	8.88	17.76	0	24.42	
Females: number ¹ .	21	2	1	0	8	31

From the analysis of the above tables it will be observed that the nasal bridge in males of our series is prevailingly of medium breadth, often of submedium breadth, and sometimes broad. Usually it is of medium height (56.0 per cent), and often low (22.0 per cent). The nasal bridge in the females tends to be lower and broader, a generally observed sex difference. Convex and concavo-convex nasal bridges are the prevailing forms.

NASAL SPINE

	?	Submedium	Medium	Pronounced	Total
Males: number . . .	1	20	14	0	35
" per cent . . .	2.85	57.14	39.99	0	
Females: number . .	0	10	9	0	19
" per cent . .	0	52.63	47.34	0	

LOWER BORDERS OF NASAL APERTURE

	Indistinct	Medium	Sharp	Total
Males: number	20	5	13	38
" per cent	52.63	13.15	34.21	
Females: number	8	7	5	20
" per cent	40.0	35.0	25.0	

¹ Percentages omitted because of inadequate series.

NASAL GROOVES

	Absent	Submedium	Medium	Pronounced	Total
Males: number. . .	26	7	2	3	38
" per cent. . .	68.38	18.31	5.26	7.89	
Females: number .	16	3	1	0	20
" per cent. . .	80.0	15.0	5.0	0	

The above tables show a prevailing poor development of the nasal spine and indistinct lower borders of the nasal aperture as characteristics of both sexes in our series. This is quite the reverse of what Fuller states to be true of the Tennessee Stone Grave series of which he says that the lower borders are "almost universally sharp" and the nasal spines usually well developed. The observations on our series, however, accord with the results of Dr. Hrdlička's findings on Arkansas and Louisiana skulls in respect to these characters.

SUB-ORBITAL FOSSAE

	Absent	Submedium	Medium	Pronounced	Total
Males: number.	0	9	14	16	39
" per cent.	0	23.07	35.89	41.02	
Females: number.	1	2	10	9	22
" per cent.	4.54	9.08	45.45	40.86	
Doubtful: number.	0	1	1	1	3

The depth of the sub-orbital fossae depends very largely upon age, to some extent upon sex, and in an indeterminate degree upon racial and individual variation. The distribution in the series under consideration, as shown above, seems to have no unusual significance.

MALARS

	Submedium	Medium	Large	Very large	Total
Males: number.	5	16	17	2	40
" per cent.	12.5	40.0	42.5	5.0	
Females: number.	11	8	0	0	19
" per cent.	57.86	42.08	0	0	
Doubtful: number.	1	0	1	0	2

ZYGOMAE

	Submedium	Medium	Large	Very large	Total
Males: number.	4	11	18	5	38
" per cent.	10.52	28.94	47.35	13.15	
Females: number.	5	10	1	0	16
" per cent.	31.25	62.50	6.25	0	
Doubtful: number.	1	0	1	0	2

As shown in the table, the malars are large in nearly half of the male crania, but not "very large," except in two cases. Rugged and massive malar bones are not nearly as common in the group from this cemetery as they are, for example, in crania from the Tennessee Stone Graves. Large malars are not found in the few female skulls in the series in which observations could be made on the facial skeleton. The marginal process on the malar bone, which Langdon found well developed in 76.4 per cent of 68 Madisonville crania, is also of common occurrence in our series.

The zygomatic arches are naturally stronger and more rugged in males than in females.

ALVEOLAR PROGNATHISM

	Absent	Submedium	Medium	Pronounced	Very pronounced	Total
Males: number . . .	1	16	12	5	0	34
" per cent. . .	2.94	47.04	35.28	14.70	0	
Females: number . .	1	7	7	4	1	20
" per cent. .	5.0	35.0	35.0	20.0	5.0	
Doubtful: number	0	1	0	0	0	1

The above tabulation shows a somewhat greater development of alveolar prognathism among female crania than among the male. Langdon remarks that prognathism "is a generally well-marked, though not constant feature of these crania."¹ Fuller, in his examination of Tennessee Stone Grace crania found a more marked tendency to alveolar prognathism among females than among males.

Teeth. As in most series of crania from old graves, so many teeth have been lost post-mortem in the present group that observations on the dentition are very unsatisfactory.

DENTITION

WEAR

	Complete	Incomplete	Total	None	Sub-medium	Medium	Pronounced	Total
Males: number .	38	3	41	1	27	9	5	42
" per cent .	92.68	7.32		2.38	64.26	21.42	11.90	
Females: number	20	6	26	2	11	6	1	20
" per cent	76.92	23.07		10.0	55.0	30.0	5.0	
Doubtful: number	2	1	3	1	1	0	1	3

The first division of the table above shows that of 41 male crania on which observations concerning the dentition could be

¹ Op. cit., p. 241.

made, 38 or 92.68 per cent showed completed dentitions. By this it is meant that all of the permanent teeth had erupted.

In the female series, 20 of a total of 26 crania showed completed dentitions. In every instance in the crania of both sexes in which the dentition was incomplete, one or more of the third molars had not erupted. Most of these, according to the age estimates, were young adults between the ages of twenty and thirty years, but several were obviously middle aged. There is clearly shown here a very marked tendency toward the suppression of third molars in the females (amounting to 23 per cent of the cases observed), while in a lesser degree (7.3 per cent) the same is true of the males. The doubtful skull in which the dentition was incomplete was that of an adolescent. In this connection it is interesting to note that Fuller found the suppression of one or more third molars in 24 of the 185 Tennessee Stone Grave crania he examined—13.9 per cent of male crania, and 11.4 per cent of female crania. This percentage doubtless would have been higher if it had been possible to estimate it on the basis of the number of crania in which dental observations were possible, instead of the entire number studied. But the author did not give the former figures.

Analysis of the table showing the degree of wear of the teeth indicates that the majority of the individuals represented were young adults and that the females included fewer aged persons than the males.

TEETH LOST IN LIFE

	Few	Many	All	Total crania
Males: number.....	1	8	2	41
“ per cent.....	2.44	19.51	4.88	
Females: number.....	1	5	1	20
“ per cent.....	5.0	25.0	5.0	

QUALITY

	Very poor	Submedium	Medium	Good	Total
Males: number.....	3	5	12	18	38
“ per cent.....	7.89	13.15	31.57	47.35	
Females: number....	3	4	8	4	19
“ per cent....	15.78	21.04	42.08	21.04	
Doubtful: number....	1	0	0	2	3



MADISONVILLE SITE

Female cranium, subbrachycephalic type

Norma lateralis

Norma verticalis

Norma facialis

Norma occipitalis

NUMBER OF CUSPS

Upper molars

	4-4-4	4-4-3	4-4-2	4-3-3	4-3-2	4-4-?	4-3-?	3-3-?	Total
Males: number	0	4	4	3	3	6	5	0	25
Females: number	1½	1	0	3½	0	3	9	1	19
Doubtful: number	1	0	0	0	0	1	1	0	3

Lower molars

	5-5-5	5-5-4	5-4-4	4-4-4	5-4-5	5-5-?	5-4-?	?-5-6	Total
Males: number	3	5	2	1	1	1	1	1	17
Females: number	1	3	0	0	0	0	0	0	4

Analysis of the above tables indicates that a higher percentage of female crania shows the loss of teeth during life, that the quality of the teeth in female crania is inferior to that in the male crania, and that the females show a more marked tendency to the reduction of molar cusps and the suppression of the third molar.

PATHOLOGY AND ABNORMALITIES

	Caries	Alveolar abscesses	Crowding	None	Total crania
Males: number	7	14	4	11	33
Females: number	10	5	2	4	16

Of the crania on which observations could be made it is evident from the above table that 66.66 per cent of the males exhibited pathological features in the shape of caries, alveolar abscesses, or maleruption of teeth due to defective development of the maxillary bones. In the case of the female crania this percentage is 75. Although we have only a short series of observations upon which to base conclusions, it seems evident that the females were more subject to dental caries. It is possible that this difference in the sexes may be due to conditions favoring the development of dental caries in women during pregnancy.

Anomalies in the suppression of third molars have been discussed above. No other reductions in dentition were observed. One male cranium, No. 57567, had a supernumerary peg tooth on the lingual side of the upper left canine.

In 185 Tennessee Stone Grave crania Fuller found 56 crania exhibiting dental caries and 32 with alveolar abscesses. Concerning this series he remarks: "There is little of the primitive in the teeth." The same may be said of our Madisonville series.

Shovel-shaped incisors, identified by Hrdlička as a characteristic of Indian teeth, were observed in 12 of the 13 male crania in which examination was possible, and in all of the 6 female crania.

Palate.

		SHAPE				
		U-shaped	Parabolic	Hyperbolic	Elliptical	Total
Males: number . .	7	20	2	4		33
" per cent . .	21.21	60.60	6.06	12.12		
Females: number	3	14	2	1		20
" per cent	15.0	70.0	10.0	5.0		

The distribution of palate form is shown in the table above. It agrees very closely with Fuller's figures for Tennessee Stone Grave crania, in which of 70 observations on male crania, 65.71 per cent were parabolic and hyperbolic, as against 66.66 per cent in our series; 22.85 per cent of Tennessee Stone Grave males had U-shaped palates, and 21.21 per cent of Madisonville males; 11.42 per cent of Tennessee crania and 12.12 per cent of Madisonville crania had elliptical palates. In the case of females the comparison shows almost as striking a similarity, for of 45 female crania examined in the Tennessee Stone Grave series, 68.88 per cent were parabolic and hyperbolic, 15.55 U-shaped, and 15.55 elliptical.

The roof of the palate was observed to be high in 9 of the male crania of our series, or 27.27 per cent, as against 26.37 per cent of the Tennessee Stone Grave series observed by Fuller. In female crania from Madisonville, 2 of 20, or 10 per cent, had high roofs, as against 22.38 per cent of the Tennessee series.

A slight development of the palatine torus occurred in 4 male crania of our series or 12.12 per cent, and in 4 of the female crania or 20 per cent. Fuller estimated the occurrence of the palatine torus in Tennessee Stone Grave males at 15 per cent, and in females at 10 per cent. There is little doubt that the shortness of our female series has fortuitously increased beyond normal the occurrence of this feature.

Skull Base.

		STYLOIDS					
		Absent	Submedium	Medium	Large	Very large	Total
Males: number . . .	1	14	19	13	3		50
“ per cent. . .	2.0	28.0	38.0	26.0	6.0		
Females: number .	2	19	5	3	0		29
“ per cent	6.9	65.3	17.2	10.3	0		

The styloid processes are frequently broken off short, but it is usually possible to judge their development by the stumps.

GLENOID FOSSA —DEPTH

	Submedium	Medium	Deep	Very deep	Total
Males: number.	1	26	24	3	54
" per cent.	1.85	48.14	44.44	5.55	
Females: number.	2	19	8	1	30
" per cent.	6.66	63.33	26.66	3.33	

The table above shows that the series is characterized as a whole by the prevalence of glenoid fossae of medium or greater depth. Females exhibit fewer instances of the latter.

POSTGLENOID PROCESS

	Submedium	Medium	Large	Very large	Total
Males: number.	6	6	5	0	17
" per cent.					29.62
Females: number.	1	0	2	0	3
" per cent.					10.0

The postglenoid process is not usually to be observed in this series. It occurs much more frequently in male crania than in female crania.

FORAMEN LACERUM MEDIUM

	Small	Medium	Large	Total
Males: number.	24	19	1	44
" per cent.	54.52	43.15	2.27	
Females: number.	18	9	0	27
" per cent.	66.6	33.3	0	

DEPRESSION OF PETROUS PARTS OF TEMPORAL BONES

	Absent	Slight	Medium	Pronounced	Total
Males: number	2	13	23	6	44
" per cent	4.54	29.51	52.25	3.62	
Females: number	2	15	10	0	27
" per cent	7.4	55.5	37.0	0	

In large-brained races the lacerate foramina are usually large and the petrous portions of the temporal bones are depressed well below the level of the basilar process of the occipital bone. A well-developed brain pushes the basilar process outward beyond the level of the rigid petrous parts. An analysis of the above table shows that our Madisonville crania do not exhibit high development in these characters.

FORAMEN LACERUM POSTERIOR

	Small	Medium	Large	Right larger	Left larger	Equal	Total
Males: number	9	30	3	17	7	18	42
" per cent	21.42	71.40	7.14	40.46	16.66	42.84	
Females: number	5	19	1	8	3	14	25
" per cent	20.0	76.0	4.0	32.0	12.0	56.0	

Where there is a difference in the size of the two posterior lacerate foramina, the right foramen is usually the larger, as may be seen from the above tabulations. Fuller states that the right foramen is usually much larger in Tennessee Stone Grave crania.

POST-CONDYLOID FORAMINA

	Absent	Small	Medium	Large	Right only	Left only	Total
Males: number...	2	5	28	1	3	1	40
" per cent...	5.0	12.5	70.0	2.5	7.5	2.5	
Females: number...	0	0	18	4	4	0	26
" per cent.	0	0	78.24	4.34	17.38	0	

PARA-MASTOID PROCESSES. These were observed in 3 male and 2 female crania.

SHAPE OF FORAMEN MAGNUM

	Irregular	Oval	Half diamond	Round	Diamond	Hexagon	Total
Males: number	4	20	8	6	2	0	40
" per cent	10.0	50.0	20.0	15.0	5.0	0	
Females: number	2	8	8	4	2	2	26
" per cent	7.69	30.76	30.76	15.38	7.69	7.69	

There is considerable variation in the shape of the foramen magnum. In the males the oval form predominates. In the table above "half diamond" means that the anterior half of the foramen is shaped like two sides of an equilateral triangle, while the posterior half is semi-circular or semi-oval.

PTERYGO-SPINOUS FORAMINA

	Indicated			Total	Complete			Total
	Right	Left	Both		Right	Left	Both	
Males: number...	3	1	4	8	1	3	1	5
" per cent...				17.0				10.63
Females: number...	1	3	1	5	1	1	1	3
" per cent.				20.0				12.0

Pterygo-spinous foramina, complete or indicated to have been completed by a fibrous bridge, are relatively common in this series.

Fuller seems to have found a higher frequency of occurrence in his Tennessee series, for he reports the foramen, or indications of it, on one or both sides in 45.71 per cent of males, and 47.54 per cent of females.

DEHISCENCES IN THE FLOOR OF THE AUDITORY MEATUS

	Right	Left	Both	Total
Males: number.....	2	3	4	9
“ per cent.....				20.0
Females: number.....	3	2	4	9
“ per cent.....				33.33

Defects in the floor of the auditory meatus are common in the crania of American Indians. Fuller found them in 14 per cent of 144 Tennessee Stone Grave crania; Dr. Hrdlička found them in 14 per cent of crania from Arkansas, and in 29 per cent of crania from Louisiana. Both of these authors also found them to occur much more commonly in the crania of females.

Mandible. Mandibles were associated with the skulls in the case of 29 males and 12 females. The more important observations on these are tabulated below.

SIZE

	Submedium	Medium	Large	Very large	Total
Males: number.....	7	13	7	2	29
“ per cent.....	24.1	44.8	24.1	6.90	
Females: number.....	2	9	1	0	12
“ per cent....	16.6	75.0	8.3	0	

MENTAL PROMINENCE

	Neutral	Submedium	Medium	Large	Very large	Total
Males: number..	1	8	15	5	0	29
“ per cent..	3.4	27.6	51.7	17.2	0	
Females: number	2	5	5	0	0	12
“ per cent	16.6	41.6	41.6	0	0	

MYLO-HYOID RIDGE

	Submedium	Medium	Pronounced	Very pronounced	Total
Males: number....	11	17	1	0	29
“ per cent....	37.9	58.6	3.4	0	
Females: number..	7	5	0	0	12
“ per cent..	58.3	41.6	0	0	

GENIAL TUBERCLES						
	Absent	Submedium	Medium	Large	Very large	Total
Males: number . . .	1	16	10	1	1	29
" per cent. . .	3.4	55.2	34.5	3.4	3.4	
Females: number . .	0	9	3	0	0	12
" per cent. . .	0	75.0	25.0	0	0	

From the above tables it may be seen that the characteristic mandible is of medium size with a medium development of the mental prominence and a medium or submedium development of the mylo-hyoid ridge. The genial tubercles are poorly developed.

Pathological Features. In the following discussion alveolar abscesses and dental caries have not been considered, as these pathological features have already been dealt with above.

LESIONS PROBABLY OF TRAUMATIC ORIGIN

	Depressed scars	Linear fractures	Miscellaneous
Males: number	9	2	4
Females: number	4	0	0

About 22 per cent of the male crania in our series show lesions that are probably due to wounds. Most common are depressed scars on various portions of the cranial vault. No. 57512 has an old perforated lesion on the left parietal near bregma, oval in shape, and 9 mm. in its longest diameter. The tip of a small flint arrowpoint is also embedded in the outer table of the left parietal, 27 mm. behind the coronal suture and 42 mm. from bregma. No. 35529 has a large depressed fracture on the right parietal, 2 cm. in diameter.

No. 35527 also has an arrowpoint embedded in the occiput. No. 57056 has a healed linear fracture of the occipital bone extending from opisthion to lambda. No. 25126 has a linear fracture of the left parietal extending diagonally from lambda to a point 3 cm. behind the coronal suture. Near the middle of this fracture and extending over an oval area for a distance of 45 mm. in its long axis is an irregular cicatrized scar with a maximum breadth of 35 mm. This is the area of impact of the blow which was apparently delivered with some blunt weapon.

No. 58733 presents a cut in the right supra-orbital ridge and a fracture of the left zygomatic arch. No. 58058 has a healed fracture of the right horizontal ramus of the mandible.



MADISONVILLE SITE

Male cranium, intermediate type

Norma lateralis
Norma verticalis

Norma facialis
Norma occipitalis

Langdon found eleven cases of fracture in 141 Madisonville crania examined by him, and one skull with the fragment of a small flint arrowpoint imbedded in the occiput.

Arthritic conditions were observed about the occipital or mandibular condyles or in the glenoid fossae of three male crania and one female cranium. In addition to this two male crania presented ankylosis of the atlas to the occiput, probably of arthritic origin. Langdon found this condition in 3 of 141 Madisonville crania examined by him.

Three female crania presented slight exostoses of doubtful origin in various regions. No. 25128, the skull of a female, presented evidence of an abscess in the left ear, which had involved extensive absorption of the bony tissue and a perforation of the tympanic plate.

No. 35528 presented a small bony protuberance on the left parietal near bregma corresponding to a deep circular impression internally, circular in shape and about 5 mm. in diameter, connected with the groove for the meningeal artery, which was unusually large and deep.

Summary of Measurements and Observations upon the Crania.

A slight degree of unintentional occipital deformation is very common in the Madisonville series, but this is pronounced in a few cases only. Apparently it has affected brachycephalic crania much more than dolichocephalic crania, and probably no crania have been changed from the dolichocephalic class to the brachycephalic class through his agency. No frontal deformation occurs.

About three-fourths of the crania are brachycephalic (plates 25, 26), and the remainder are mesocephalic (plates 27, 28, 29), with the exception of two, which are dolichocephalic. Three-fourths or more are hypsicephalic and the rest orthocephalic. The breadth-height index is medium in about half of the series and low in the majority of the remainder. The cranial capacity is well up to the average for Indians. The skull walls are not extraordinarily thick. The forehead is a little narrower than average for Indians.

The faces are broad and quite short; the majority being euryprosopic and the rest mesoprosopic. The orbits are variable, but the majority are chamaeconch or microseme. The nose is short and broad, and platyrrhine indices are in the majority. There is some alveolar prognathism but practically no facial prognathism. The palate is brachyuranic and the lower jaw is short and broad.

Catalogue No.	Sex	Age	Deformation	Length	Breadth	Height	Cranial Index	Height-Length Index	Height-Breadth Index	Menton-Nasion Height (a)	Alveon-Nasion Height (b)	Diam. Bizygomatic maxin. (c)	Facial Index, total $\left(\frac{a \times 100}{c}\right)$	Facial Index, upper $\left(\frac{b \times 100}{c}\right)$	Basion-Alveon (x)
18205	♂	mid.	—	180	145	138	80.56	76.67	95.17	?	74	145	?	51.03	101
18207	♂	y. ad.	—	176	151	?	85.80	?	?	?	71	?	?	?	?
25123	♂	y. ad.	sl. oc.	177	152	139	85.88	78.53	91.45	?	69	(143)	?	(48.25)	92
25124	♂	y. ad.	sl. oc.	173	152	126	87.86	72.83	82.89	107	67	(141)	75.89	(47.51)	100
25126	♂	y. ad.	—	177	138	139	77.97	78.53	100.72	?	?	?	?	?	?
25130	♂	y. ad.	sl. oc.	177	150	139	84.75	78.53	92.67	124	78	148	83.78	52.70	105
25131	♂	y. ad.	—	177	141	138	79.66	77.97	97.87	115	71	137	83.94	51.82	102
25132	♂	mid.	pron. l. oc.	(163)	(148)	?	(90.80)	?	?	(117)	(70)	140	83.57	(50.00)	?
26587	♂	mid.	—	184	146	140	79.35	76.09	95.89	?	?	?	?	?	?
26593	♂	old	pron. oc.	(178)	(147)	(141)	(82.58)	79.21	95.92	?	?	?	?	?	?
26599	♂	old	sl. oc.	173	142	140	82.08	80.92	98.59	?	?	?	?	?	?
26605	♂	y. ad.	sl. oc.	178	138	?	77.53	?	?	117	70	139	84.17	50.36	?
26609	♂	y. ad.	sl. oc.	164	137	134	83.54	81.71	97.81	?	?	?	?	?	?
26627	♂	y. ad.	sl. oc.	173	(154)	134	(89.02)	77.46	(87.01)	120	72	(140)	(85.71)	51.42	102
26988	♂	y. ad.	sl. oc.	161	144	129	89.44	80.12	89.58	114	70	136	83.82	42.16	101
28294	♂	y. ad.	sl. oc.	176	147	?	83.52	?	?	?	?	?	?	?	?
35524	♂	mid.	sl. oc.	182	140	141	76.92	77.47	100.71	122	74	149	81.88	49.66	99
35525	♂	y. ad.	—	182	137	138	75.27	75.82	100.73	?	70	135	?	51.85	102
35526	♂	y. ad.	sl. oc.	177	149	135	84.18	76.27	90.60	?	74	143	?	51.74	?
35527	♂	mid.	sl. oc.	179	150	143	83.80	79.89	95.33	?	?	?	?	?	?
35528	♂	y. ad.	sl. oc.	167	147	?	88.02	?	?	?	?	?	?	?	?
57502	♂	y. ad.	sl. oc.	176	138	135	78.41	76.70	97.83	?	70	?	?	?	104
57504	♂	y. ad.	sl. oc.	169	(156)	?	(92.31)	?	?	109	66	?	?	?	?
57506	♂	y. ad.	sl. oc.	174	140	132	80.46	75.86	94.29	?	?	?	?	?	?
57567	♂	y. ad.	—	?	?	?	?	?	?	116	73	(137)	84.67	53.28	100
57608	♂	y. ad.	pron. r. oc.	(177)	(146)	(139)	(82.49)	(78.53)	(95.21)	121	74	?	?	?	99
57579	♂	y. ad.	sl. oc.	173	153	137	88.44	79.19	89.54	?	67	(143)	?	46.85	105
57507	♂	y. ad.	—	182	148	137	81.32	75.27	92.57	?	?	?	?	?	?
57519	♂	y. ad.	sl. oc.	179	145	139	81.01	77.65	95.86	?	?	?	?	?	?
57625	♂	mid.	sl. oc.	169	148	?	87.57	?	?	?	?	?	?	?	?
57636	♂	mid.	sl. oc.	188	(144)	138	(76.60)	73.40	(95.83)	?	?	?	?	?	?
57555	♂	y. ad.	—	181	145	138	80.11	76.24	95.17	?	?	?	?	?	?
58533	♂	y. ad.	sl. oc.	180	149	131	82.78	72.78	87.92	?	(69)	?	?	?	101
58542	♂	mid.	—	173	143	?	82.66	?	?	109	70	(136)	(80.15)	(51.47)	?
58540	♂	y. ad.	sl. oc.	181	138	131	76.24	72.38	94.93	?	?	?	?	?	?
58058	♂	old	sl. oc.	187	146	136	78.07	72.73	93.15	120	72	(145)	(82.76)	49.65	104
57597	♂	mid.	sl. oc.	185	155	147	83.78	79.46	94.84	?	81	?	?	?	105
57568	♂	mid.	med. oc.	176	156	134	(88.64)	76.14	85.90	114	(69)	?	?	?	?
57646	♂	old	—	177	133	?	75.14	?	?	?	?	?	?	?	?
57647	♂	y. ad.	pron. oc.	(173)	154	?	(89.02)	?	?	?	?	?	?	?	?
58541	♂	mid.	sl. oc.	172	141	139	81.98	80.81	98.58	?	79	141	?	56.02	98
58539	♂	y. ad.	sl. oc.	195	160	143	82.05	73.33	89.38	125	76	139	89.93	54.67	96
58538	♂	mid.	{ lat. p. m. sl. oc.	(184)	(141)	(139)	(76.63)	(75.54)	(98.58)	?	69	?	?	?	95
58534	♂	mid.	sl. oc.	176	144	138	81.82	78.41	95.83	?	74	136	?	54.41	91
58023	♂	old	—	179	153	140	85.47	78.21	91.50	?	(73)	(138)	?	(52.89)	(96)

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Catalogue No.	Sex	Age	Deformation	Length	Breadth	Height	Cranial Index	Height-Length Index	Height-Breadth Index	Menton-Nasion Height (a)	Alveon-Nasion Height (b)	Diam. Bizygomatic max. (c)	Facial Index, total $\left(\frac{a \times 100}{c}\right)$	Facial Index, upper $\left(\frac{b \times 100}{c}\right)$	Basion-Alveon (x)
59724	♂	mid.	—	183	146	134	79.78	73.22	91.78	121	74	147	82.31	50.34	100
59729	♂	mid.	sl. oc.	175	150	135	85.71	77.14	90.00	120	(72)	140	85.71	51.42	(102)
59731	♂	mid.	sl. oc.	175	142	135	81.14	77.14	95.07	?	?	?	?	?	?
59732	♂	y. ad.	—	184	137	136	74.46	73.91	99.27	112	67	(132)	84.85	50.76	103
59733	♂	y. ad.	—	179	138	131	77.09	73.18	94.93	121	75	136	88.97	55.14	102
59735	♂	mid.	sl. oc.	180	148	136	82.22	75.56	91.89	131	(79)	(150)	(87.33)	(52.40)	108
26990	♂	y. ad.	sl. oc.	189	155	140	82.01	74.07	90.32	?	73	149	?	48.99	98
57512	♂	y. ad.	sl. oc.	180	152	139	84.44	77.22	91.45	121	73	(144)	(84.03)	(50.69)	104
18206	♀	y. ad.	—	167	133	130	78.70	76.92	97.74	?	64	?	?	?	100
25125	♀	y. ad.	—	171	138	127	80.70	74.27	92.03	?	?	126	?	?	?
25127	♀	mid.	{ med. p. m.	(171)	(150)	(141)	(87.72)	(82.46)	(94.00)	?	?	?	?	?	?
25128	♀	y. ad.		161	142	134	88.20	83.23	94.37	?	?	?	?	?	?
25133	♀	y. ad.	sl. oc.	161	141	124	87.58	77.02	87.94	?	67	133	?	50.38	93
25134	♀	med.	sl. oc.	169	145	128	85.80	75.74	88.28	?	72	136	?	52.94	102
25135	♀	y. ad.	—	171	142	134	83.04	78.36	94.37	?	69	?	?	?	97
25136	♀	y. ad.	sl. oc.	167	141	135	84.43	80.84	95.74	?	63	128	?	49.22	94
25137	♀	y. ad.	—	166	139	137	83.73	82.53	98.56	?	?	?	?	?	?
26591	♀	y. ad.	sl. oc.	169	144	132	85.21	78.11	91.67	105	62	?	?	?	100
26597	♀	y. ad.	sl. p. m.	175	140	124	80.00	70.86	88.57	?	67	?	?	?	(104)
26621	♀	y. ad.	sl. oc.	174	145	133	83.33	76.44	91.72	113	68	136	83.09	50.00	101
26601	♀	mid.	sl. oc.	169	145	125	85.80	73.96	86.21	?	?	?	?	?	?
26626	♀	y. ad.	sl. oc.	166	144	124	86.75	74.70	86.11	104	64	126	82.54	50.79	(102)
26628	♀	mid.	sl. oc.	177	139	?	78.53	?	?	?	63	130	?	48.46	?
57505	♀	y. ad.	sl. oc.	167	139	132	83.23	79.04	94.96	?	61	(133)	?	45.86	96
57559	♀	y. ad.	pron. oc.	(167)	(142)	(129)	(85.03)	(77.25)	(90.85)	?	64	133	?	48.12	96
58536	♀	y. ad.	sl. oc.	179	126	127	70.39	70.95	100.79	?	?	?	?	?	?
58532	♀	y. ad.	sl. oc.	175	140	135	80.00	77.14	96.43	113	69	134	84.33	51.49	104
57514	♀	y. ad.	med. oc.	161	149	?	(92.55)	?	?	?	?	?	?	?	?
57620	♀	y. ad.	sl. oc.	170	145	134	85.29	78.82	92.41	?	?	?	?	?	?
57544	♀	mid.	med. oc.	171	144	134	84.21	78.36	93.06	?	63	(129)	?	(48.84)	94
57558	♀	y. ad.	sl. oc.	169	136	129	80.47	76.33	94.85	?	69	?	?	?	99
58049	♀	old	sl. oc.	167	148	139	88.62	83.23	93.92	?	?	?	?	?	?
58009	♀	y. ad.	sl. oc.	163	138	132	84.66	80.98	95.65	115	69	(132)	(87.12)	52.27	103
58025	♀	mid.	pron. oc.	(165)	(146)	(138)	(88.48)	(83.64)	(94.52)	?	?	?	?	?	?
59723	♀	y. ad.	—	179	138	127	77.09	70.95	92.03	109	70	125	87.20	56.00	98
59730	♀	old	sl. oc.	168	148	132	88.10	78.57	89.19	?	?	?	?	?	?
57645	♀	y. ad.	sl. oc.	164	143	129	87.20	78.66	90.21	113	67	(138)	81.88	(48.55)	103

Key to abbreviations.

Age: y. ad. = young adult; mid. = middle aged; old = past middle age.

Deformation: sl. = slight; med. = medium; pron. = pronounced; oc. = occipital; r. = right; l. = left; p. = post-mortem.

Figures in parentheses indicate that the measurement is approximate, either because of deformation or because the parts are broken.

Diam. Frontal minim.	Diam. Bignonial	Angle of Lower Jaw, mean.	Height of Symphysis	Orbits — Height, right, left		Orbits — Breadth, right, left		Orbital Index, mean	Nose Height	Nose Breadth maxim.	Nasal Index	Palate, External Length (l)	Palate, External Breadth, maxim. (b)	Palatal Index ($b \times 100$)	Circumference, maxim. (above ridges)	Arc, Nasion-Opisthion	Capacity (Hrdlicka's method)	Thickness of left Parietal above T. P. Suture
				R.	L.	R.	L.											
92	109	132	38	36	34	40.5	40.5	81.48	53	27	50.94	57	71	124.56	525	369	1580	4
95	105	123	(30)	35	36.5	38.5	39	92.25	55	28	50.91	54	62	114.81	521	351	1485	6
90	?	?	?	?	?	?	?	?	?	?	?	?	?	?	502	345	1295	6
96	100	123	35	36	37	44	44	83.45	48	27	56.25	54	65	120.37	510	368	1425	?
91	99	130	36	34	33	44	43	77.00	55	29	52.73	59	68	115.25	502	352	1290	6
94	106	117	38	35	37	44	43	82.80	58	27.5	47.41	(59)	(70)	(118.64)	514	348	1375	?
100	?	?	?	35	34	42	42	84.52	50	27.5	55.00	56	69	123.21	537	379	1570	7
93	101	119	37	34	34	44	43	78.17	55	26	47.27	58	67	115.52	518	368	1585	7
92	?	?	?	33	33.5	39	39	85.26	47	25	53.19	54	62	114.81	486	345	1220	6
92	?	?	?	31.5	32.5	38.5	39	82.57	50	26	52.00	(46)	63	(136.96)	489	348	1340	4
103	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	7
93	?	?	?	?	?	?	?	?	?	?	?	?	?	?	485	(338)	?	6
97	?	?	?	33	34	38	38	88.16	48	27	56.25	51	67	131.37	481	328	1180	5
96	?	?	?	32	32	41	41	78.05	49.5	27	54.55	58	65	112.07	507	?	?	6
89	?	?	?	35	34.5	39	38	90.27	52	26	50.00	52	61	117.31	498	342	1325	7
89	?	?	?	33.5	32	39	38	85.06	41.5	28.5	68.67	50	(58)	(116.00)	487	339	1220	7
93	?	?	?	?	?	?	?	?	?	?	?	?	?	?	489	344	1300	5
95	105	?	32	32	31.5	?	44	71.59	48	26	54.17	51	64	125.49	500	340	1320	6
85	?	?	?	32	33	40	39	82.31	48	27	56.25	(52)	60	(115.38)	505	(348)	?	6
96	96	125	34	33	33.5	41	40	82.12	48	28	58.33	53	60	113.21	(512)	?	?	5
99	?	?	32	?	?	?	?	?	?	?	?	?	?	?	502	348	?	6
86	93	127	30	31	33	40	41	79.00	48	26	54.17	(52)	(58)	(111.54)	462	?	(1230)	6
97	?	?	?	34	34	38.5	39	87.74	48	30	62.50	51	62	121.57	508	?	(1360)	6
96	?	?	?	32	32	39	39	82.05	46.5	29	62.37	49	61	124.49	492	350	1350	7
92	?	?	?	32	32	41	39	80.05	49	28.5	58.16	53	64	120.75	462	340	1355	5
89	?	?	?	?	?	?	?	?	?	?	?	?	?	?	494	349	1150	5
99	112	123	36	32	31	39	38.5	81.29	48	26	54.17	61	66	108.20	515	350	1340	6
?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
95	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	6
91	?	?	?	33.5	34.5	40	40.5	84.46	49	26	53.06	(51)	(60)	(117.65)	501	354	1380	5
90	?	?	?	33	33	40	40	82.50	52	26	50.00	55	65	118.18	486	330	1205	6
99	?	?	?	?	?	?	?	?	?	?	?	?	?	?	511	365	(1365)	7
85	96	129	35	34.5	33.5	39	38	88.31	51	26	50.98	54	66	121.29	475	?	(1175)	4
90	?	?	?	?	?	?	?	?	?	?	?	?	?	?	491	354	(1250)	7
90	89	125	29	33.5	33.5	41	38.5	84.36	54	25	46.30	53	58	109.43	506	350	1350	5
90	104	129	31	?	31	?	38	81.58	49	25	51.02	?	?	?	498	345	(1375)	?
93	98	127	33	32	33	40	40	81.25	48	30	62.50	56	67	119.64	483	335	1240	6

The frontal region is medium or low in height, medium or narrow in breadth, and medium or receding as to slope, except in females, who exhibit more instances of bulging frontals.

The sagittal region is medium or broad with little development of the median sagittal elevation. Temporal and occipital regions are variable, as is natural in a mixed group. In about two-thirds of cases the sutures are simple in serration, and in the rest medium. Obliteration usually begins in the sagittal suture and the pterions are almost invariably of the broad H form. Sutural bones are very common.

Parietal foramina are few and small; retromastoid foramina exceedingly variable. The mastoid processes are usually rather small or medium in males; in females they are often rather large for the sex.

Brow ridges are not unusually large except in a few cases. Frequently they are submedium in development, even in males. Orbits are usually low and oblong in shape with rounded corners. The nasion depression in both sexes is poorly marked, often entirely absent. The nasal bridge is variable in breadth and height, but medium in about half of all cases. Convex and concavo-convex forms are most common. The nasal spine is usually poorly developed and the lower borders are frequently indistinct. On the other hand subnasal grooves or fossae are uncommon.

Molars and zygomae are medium or large in males as characteristic of American Indians, but in the females frequently small. Depth of suborbital fossae is variable. The palate is prevailing parabolic, sometimes U-shaped or elliptical.

The teeth show marked tendency toward cusp reduction and suppression of third molars. Usually they are not large. Decay and loss in life are frequent.

The glenoid fossae are of medium depth or more; dehiscences in the floor of the auditory meatus are common. The middle lacerated foramina are submedium to medium in size; the depression of the petrous parts is small or medium; the posterior lacerated foramina are prevailing medium in size, but frequently small, and, when of unequal size, the right is usually larger.

While the mandibles are usually of medium size and medium development in the majority of cases as regards points of interest,

there is a large sub-group in which the prominence of the chin is submedium, and the development of the mylo-hyoid ridge is submedium. The genial tubercles are prevailingly small.

In general it is apparent that this group is the result of a mixture of the southern brachycephalic type with the eastern dolichocephalic type, the latter type being distinctly in the minority. While both types have been modified by the mixture it is clear that the dolichocephalic type has suffered most in this regard and persists for the most part only in an intermediate form. To ascertain the exact results of the intermixture it would be necessary to investigate the correlation of all measurements and morphological features in the individual crania. It is not possible to attempt this within the prescribed limits of this paper, but such correlations are valuable and it is hoped that they may be presented subsequently.

The Bones in General. Of the large collection of human remains from the Madisonville cemetery in the Peabody Museum, the vast majority are fragmentary and incomplete. The writer examined the skeletons of 53 adult males, 35 adult females, 2 adults of doubtful sex, 9 adolescents, 6 children, and 7 infants. No detailed study of the bones was possible in the time allotted for the investigation, and it was necessary to confine the attention to the few most important measurements and observations on the better preserved specimens.

In almost all of the skeletons the ribs, vertebrae, scapulae, and pelvic bones are missing or fragmentary; the majority of the skulls are crushed and broken beyond repair except at an excessive expenditure of labor; most of the long bones have been broken. There is not one complete skeleton in good condition in all of the collections sent in by Metz, Swanton, and the Merwin brothers. Doubtless the fragmentary condition of the skeletons is due to the shallowness of the graves and the fact that the site is heavily timbered with large trees that for the most part have grown up since the period of occupation.

Femur.

	MEASUREMENTS							
	Length Bicondylar		Length Maximum		Maximum diameter of head		Humero-femoral index	
	No. of cases	mm.	No. of cases	mm.	No. of cases	mm.	No. of cases	Index
Males								
Average: right, paired . .	20	444	21	449	24	47.2	13	71.69
" " total	29	448	28	453	29	47.4	21	71.56
" left, paired . .	20	447	21	451	24	46.7	13	70.61
" " total	24	447	25	451	28	46.7	18	70.60
Minimum: right	29	405	28	412	29	43	21	69.90
" left	24	407	25	413	28	42	18	67.92
Maximum: right	29	515	28	522	29	52	21	74.40
" left	24	487	25	490	28	51	18	72.93
Females								
Average: right, paired . .	14	409	14	415	16	43.6	5	72.14
" " total	18	410	18	415	19	43.8	12	73.35
" left, paired . .	14	415	14	420	16	42.3	5	70.23
" " total	19	419	19	426	21	42.1	9	70.72
Minimum: right	18	377	18	385	19	39	12	70.40
" left	19	390	19	395	21	39	9	68.06
Maximum: right	18	446	18	448	19	47	12	76.65
" left	19	454	19	457	21	45	9	73.34

The mean bicondylar length of male Madisonville femora is 447.5 mm. which corresponds to an average stature of a little less than 167 cm. according to Manouvrier's tables. If we calculate the stature from the maximum length of the femora according to Pearson's formula (*a*), the average stature is a little more than 166 cm.

Similarly the average stature of Madisonville females, according to Manouvrier's tables, is a little more than 155 cm. and, according to Pearson's formula, a little less than 155 cm. Hrdlička found that the stature of Munsee males was approximately 167 cm. and of Munsee females 156 cm., basing his computations upon the mean bicondylar length of femora.

The difference between the bicondylar and maximum length of the femur averages 4.5 mm. in males (taking the mean of both sides) and 6 mm. in females. These differences are practically identical with those in the lengths of Munsee femora, determined by Dr. Hrdlička (nearly 5 mm. in males and 6 mm. in females). He considers this unusual disproportion in the two lengths as possibly due to an unusual breadth of pelvis, a greater length of the femoral neck, or a more than usual prevalence of the habit of squatting.

The maximum diameter of the femoral head in males averages 47.4 mm. in rights and 46.7 in lefts. In the case of females the figures are 43.8 for right femora and 42.1 for left femora.

The humero-femoral index ($\frac{\text{maximum length of humerus} \times 100}{\text{bicondylar length of femur}}$) averages in males 71.56 on the right side and 70.6 on the left side. This is slightly below the average for Indians given by Dr. Hrdlička in his exhaustive study, *Physical Anthropology of the Lenape* p. 61, (100 Indians, right 72.3; left 71.6). It approximates more closely to the index in the Munsee (right 71.8; left 71.7).

The index in females is a little higher on both sides, but markedly higher on the right side than in the case of the males.

SUBTROCHANTERIC REGION OF SHAFT

		Diameter Minimum (a) mm.	Diameter Maximum (b) mm.	Platymeric index $\frac{(a) \times 100}{(b)}$
Number				
Males				
Average: right, paired....	26	25.7	33.5	77.08
" " total.....	32	25.8	33.6	77.16
" left, paired....	26	26.0	34.0	76.72
" " total.....	28	26.0	34.0	76.72
Minimum: right.....	32	21.5	29	65.71
" left.....	28	22	30	63.89
Maximum: right.....	32	32	39.	94.12
" left.....	28	33	39	90.91
Females				
Average: right, paired....	20	22.7	31.3	72.62
" " total.....	22	22.6	31.2	72.84
" left, paired....	20	23.3	30.9	75.50
" " total.....	23	23.5	30.9	76.15
Minimum: right.....	22	20	28.5	61.76
" left.....	23	19	27	62.86
Maximum: right.....	22	28	34	83.33
" left.....	23	28	35	87.50

From an inspection of the table given above it may be seen that a moderate degree of subtrochanteric flattening or platymeria is exhibited in the femora of Madisonville males, and that this flattening is slightly more pronounced in the left femora than in the right, although the absolute diameters of the left femora at this region are greater. This is usual in most racial groups.

In the case of the females the flattening is more pronounced on both sides than in the males, as is usually the case, but the right femora of females are more flattened than the left. This is due to an increase in the minimum diameters and a decrease in the maximum diameters of the left femora as compared with the right. This is

an unusual and puzzling sex difference. It may be a chance error due to the shortness of our female series, but it is more probably of some functional significance. What this may be the writer is unable to say.

Platymeria is much less pronounced in the Madisonville group than in the Munsee group studied by Dr. Hrdlička, in which the indices for males are 73.3 and 71.6 for the right and left sides respectively, and for the females 75.5 and 71.7.

MIDDLE OF SHAFT				
	Number	Diameter Antero-posterior (c) mm.	Diameter Lateral (d) mm.	Middle index $\frac{(d) \times 100}{(c)}$ (c)
Males				
Average: right, paired....	23	29.2	26.8	92.16
" " total.....	27	29.7	26.7	90.43
" left, paired....	23	30.1	26.9	89.25
" " total.....	28	30.1	27.0	89.79
Minimum: right.....	27	24	22.5	76.47
" left.....	28	24	22	78.13
Maximum: right.....	27	35	30	111.54
" left.....	28	35	30	100.0
Females				
Average: right, paired....	20	24.8	23.3	94.05
" " total.....	23	24.8	23.4	94.41
" left, paired....	20	26.0	24.8	95.70
" " total.....	22	26.3	25.0	95.45
Minimum: right.....	23	22	22	82.14
" left.....	22	23	22	82.76
Maximum: right.....	23	28	26.5	104.17
" left.....	23	29	28	112.50

From the above table it may be seen that in both males and females of the Madisonville group the diameters at the middle of the shaft show that the left femora are stronger than the right. But the middle index ($\frac{\text{diameter antero-posterior}}{\text{diameter lateral} \times 100}$) is higher on the right side in males and on the left side in females. In the Munsee group studied by Hrdlička the shaft index is higher on the left side in both sexes. In both males and females, and upon both sides, the shaft index is higher in the Madisonville group than in the Munsee group.

MEAN DIAMETER OF FEMUR AT MIDDLE OF SHAFT

	Madisonville mm.	Munsee (Hrdlička) mm.
Males: right.....	28.2	27.3
" left.....	28.5	27.5
Females: right.....	24.1	24.6
" left.....	25.6	24.3

The Madisonville males exceed the Munsee males in mean diameter of the femur at the middle of the shaft, but in the case of the females the Munsee femora show larger diameters for the right side but smaller for the left side.

OBSERVATIONS ON THE FEMUR. LINEA ASPERA

	Subjects	Number of bones	Submedium Per cent	Medium Per cent	Pronounced Per cent
Males.....	27	47	34.04	29.78	36.17
Females.....	20	34	58.82	35.29	5.88

The linea aspera in this series is not as well developed as in many Indians. The sexual differences according to observation are given in the preceding table. On the whole the muscular development seems to have been good, but not excessive.

The shape of the shaft is prevailingly prismatic, or approximately so, but elliptical and plano-convex types occur, as well as many intermediate forms.

The third trochanter occurs as a rounded tuberosity in 10.6 per cent of males and in 12.5 per cent of females. The ridge form, or *Crista hypotrochanterica*, is much more common, while a well developed depression or *Fossa hypotrochanterica* was observed in two cases only. When the third trochanter appears as a round tuberosity it is often associated with a slight development of the linea aspera and a pronounced torsion.

The present writer made no measurements of femoral torsion, but Dr. W. C. Farabee has generously placed at his disposal the results of an unpublished investigation made by him upon the Madisonville femora. The mean angles of torsion for 37 pairs of Madisonville femora are, left, 12.3; right, 26.9. Dr. Farabee writes:

The angle of torsion is much less on the left than on the right. All the negative angles (eight) are on the left, and the angles on the right are large. In 37 pairs the angle is larger on the left in 7 cases only.

Tibiae.

	Number of cases	Length (minus spine) mm.	Number of cases	Tibio-femoral index $\frac{T \times 100}{F}$
Males				
Average: right, paired....	15	375.0	8	83.41
" " total.....	19	374.7	12	83.08
" left, paired....	15	377.2	8	82.83
" " total.....	24	378.2	15	83.43
Minimum: right.....	19	343	12	79.23
" left.....	24	347	19	81.31
Maximum: right.....	19	417	12	85.10
" left.....	24	431	19	86.98
Females				
Average: right, paired....	12	349.9	8	84.46
" " total.....	14	347.5	11	84.20
" left, paired....	12	350.2	8	83.33
" " total.....	16	347	11	82.75
Minimum: right.....	14	325	11	81.75
" left.....	16	329	11	79.46
Maximum: right.....	14	376	11	87.61
" left.....	16	375.	11	86.22

The mean length of male tibiae of both sides is 376.4 mm. and of females 347.2 mm. The mean length of female bones is 94.8 per cent of male bones, which is about the same as the ratio in miscellaneous New York Whites according to Hrdlička (94.6), and somewhat higher than that of Louisiana tibiae (93.7), and Munsee tibiae (91.7).

The tibio-femoral index is somewhat higher than that in Whites (approximately 82, according to Hrdlička). It is higher on the right side than on the left in both sexes and whereas it is lower in the females of most racial groups, in the Madisonville series the females have a slightly higher index on the right side than the males, and a lower index on the left side. The series, however, is very short.

	Middle shaft diameters			Middle index (b) \times 100 (a)	Level of nutrient foramen			Index (d) \times 10 (c)
	Cases	Antero- posterior (a)	Lateral (b)		Cases	Antero- posterior (c)	Lateral (d)	
Males								
Average: right, paired	26	33.0	23.3	70.91	32	37.1	24.0	64.85
" " total	30	32.7	23.3	71.62	35	37.0	24.2	65.50
" left, paired	26	34.1	23.0	68.83	32	37.0	24.1	65.30
" " total	32	33.5	23.1	69.55	35	37.3	24.2	65.09
Minimum: right....	30	26	18	60.00	35	30	19	53.41
" left.....	32	27	18	57.14	35	30	20	50.00
Maximum: right....	30	39	28	86.21	35	44	29	78.79
" left.....	32	43	28	92.86	35	46	29	78.79
Females								
Average: right, paired	15	27.6	20.8	75.58	16	30.6	22.0	71.95
" " total	19	27.5	20.8	75.70	20	30.6	22.0	72.13
" left, paired	15	27.6	20.3	74.17	16	30.9	21.6	70.01
" " total	17	27.5	20.3	74.17	19	30.8	21.4	69.65
Minimum: right....	19	25	19	63.33	20	27	19	62.86
" left.....	17	25	18	64.29	19	28	18	56.67
Maximum: right....	19	30	23	88.46	20	35	25	85.19
" left.....	17	29	22	88.00	19	35	25	80.65

The middle index of the tibiae is higher in females than in males and higher in both sexes on the right side than on the left. In the preceding table have been included also diameters and indices taken at the level of the nutrient foramen, where the flattening is at its maximum. As a group it cannot be said that the Madisonville Indians exhibited pronounced platycnemy, although this condition is found to a very marked degree in some individuals.

In 51 left tibiae, Dr. Farabee found an average torsion of 18.7° with a range of from 5° to 35° . The average angle of torsion of 64 right tibiae is 18° , with a range from 5° to 32° .

Observations on Tibiae. The Madisonville tibiae include a rather large number which show inflammatory lesions, a subject which will be discussed below. Aside from this there are few anomalies. The retroversion of the head is moderate or absent in most of the cases. Only two bones exhibited convexity of the lateral condyle. Two individuals had the so-called "boomerang tibiae" probably or possibly due to rachitis. Extensions of the inferior articular surface above the anterior tibial border ("squatting facets") are quite common.

SHAPE OF SHAFT AT MIDDLE¹

	1	2	3	4	5	6	Total bones	Total individuals
Males: per cent	27.8	20.9	37.2	0	13.9	0	43	25
Females: per cent	50.0	34.3	15.6	0	0	0	32	19

¹ 1, ordinary prismatic; 2, lateral prismatic; 3, external surface concave; 4, posterior surface divided into two by vertical ridge; 5, interior border indistinct, posterior half of bone oval; 6, plano-convex. (Classifications of Dr. Hrdlicka.)

It may be noted that type 3 (with concave external surface) is most common among the males, and type 1 (ordinary prismatic) occurs in half of all the female tibiae. Types 4 and 6 were not found in this group. These observations are not precisely comparable with those of Dr. Hrdlička who notes a seventh type of indefinite shape which includes 35 per cent of Munsee tibiae and 45 per cent of miscellaneous Whites and United States Negroes. The present writer has assigned all bones to one or other of the six primary types, finding none in the Madisonville group which did not conform to the classification. Possibly a personal equation enters into the difference in results, but it is notable that the Munsee group (both sexes) includes 20 per cent of type 4 (more or less quadrilateral) while none of our series belong to this type.

Fibula. The number of fibulae in condition fit for measurement was so small that conclusions in regard to size cannot reasonably be made.

Humerus.

LENGTH, MAXIMUM					
	Number	Right mm.	Number	Left mm.	
Males					
Average: paired	18	317.2	18	314.2	
" total	23	317.7	25	316.2	
" minimum	23	295	25	290	
" maximum	23	345	25	370	
Females					
Average: paired	8	302.1	8	296.8	
" total	15	303.7	11	295.6	
" minimum	15	289	11	275	
" maximum	15	323	11	322	

MAXIMUM DIAMETER ARTICULAR HEAD					
	Number	Right mm.	Number	Left mm.	
Males					
Average: paired	20	45.9	20	45.2	
" total	25	46.2	25	44.9	
" minimum	25	41	25	40	
" maximum	25	51	25	50	
Females					
Average: paired	13	40.2	13	39.8	
" total	18	40.4	13	39.8	
" minimum	18	38	13	38	
" maximum	18	44	13	43	

In both males and females the right humerus is longer than the left, more especially so in the females. In both sexes the lengths are somewhat shorter than those of the Munsee Indians. The mean length of paired female humeri in relation to paired male humeri is as 94.8 to 100, a very high ratio, which is comparable to that found by Hrdlička in the Munsee (94.2) and in the American Negro (94.6). In Indians in general it averages 91.2 according to the same author. The possibility of an error in sexing the humeri is to be considered in this connection, but, in general, sexual differences in the bones are well marked and identification of sex was not based upon one bone only, but upon all skeletal parts present. Only adult humeri were measured.

A well defined sexual difference occurs in the maximum (vertical) diameter of the superior articular surface. In both sexes this diameter is somewhat larger on the right side than on the left.

Perforation of the septum between the olecranon and coronoid fossae of the humerus occurs in but 3 of 57 male bones or 5.7 per cent, and in 15 of 39 female bones or 38.4 per cent.

There is no instance of the occurrence of a supracondyloid process or foramen.

Radius.

	LENGTH, MAXIMUM				RADIO-HUMERAL INDEX			
	Right		Left		$\frac{R \times 100}{H}$			
	Number	mm.	Number	mm.	Right Index		Left Index	
Males								
Average: total	8	243.6	11	242.1	7	77.85	11	77.18
Females								
Average: total	6	236.4	6	234.6	5	77.73	3	79.17

The total number of radii available for measurement is 19 in the males and 12 in the females. In both sexes the right radius is somewhat longer, but too much confidence should not be placed in the figures given above, for the radii are almost all odd and not paired.

In the few cases in which the radio-humeral index could be calculated the results agree fairly well with those given by Dr. Hrdlička as characteristic of Indians in general (approximately 78 on both sides for males and 77 on both sides for females). The excess in the humero-radial index on the left side in the females is probably due to the insufficient number of cases.

There is nothing exceptional in the features of the radii of this series.

Ulna. Of the male bones, 6 right ulna yielded an average of 267.1 mm. for maximum length, while 8 left ulna averaged 258 mm. These were not paired bones. In the case of the females the averages are 247.8 mm. for 5 right ulna, and 254.6 mm. for 3 left ulna. Nothing noteworthy was observed in respect to the ulna.

Pelvis. In this collection the bones of the pelvis are almost without exception fragmentary. But one pelvis, that of a female, was available for measurement. This is a very broad and capacious pelvis, the measurements of which are given below.

PELVIS AS A WHOLE			
	Mean height of ossa innominata (a) mm.	Breadth, maximum, of pelvis (b) mm.	Pelvic index $\frac{(a) \times 100}{b}$
Female 1	205	288	71.18

SUPERIOR STRAIT			
	Breadth Maximum (c)	Diameter Anteroposterior (d)	Brim index $\frac{(d) \times 100}{(c)}$
	143	122	85.31

The pelvic index is very low in this specimen and the brim index is very high. Altogether this is an exceptionally large pelvis, and consequently should not be taken as representative of the group.

Observations on many fragmentary pelvises show that the usual pelvic characters with their normal sexual differentia prevail. The female pelvises have wider great sciatic notches, greater sub-pubic angles, and the ascending rami of the pubic bones are less massive than in the males. The so-called pre-auricular sulcus is decidedly an unsafe criterion of sex in this series, being well-marked in many obviously male pelvises and indistinct in many female pelvises.

The total number of sacra available for measurement was 7, which seems too small a number upon which to base any conclusions.

Pathology. The following is a summary of pathological conditions observed in the bones apart from the skull. These pathological conditions were confined to the bones of adults and one adolescent.

Spine (total number of adult subjects, 90). Slight to pronounced arthritic exostoses were observed on the vertebra of 17 individuals,

or 18.8 per cent of all the adult skeletons examined including those in which the vertebrae were not preserved.

In one male skeleton in addition (No. 57561) several of the cervical vertebrae appear to be carious.

Pelvic Bones. Signs of arthritis were observed about the acetabula of 6 subjects. In addition the right sacro-iliac articulation of No. 57640, an adult female, exhibits an inflammatory condition, involving considerable destruction of bone. No. 57625, a fragmentary skeleton, probably female, shows arthritic exostoses in the region of the pubic symphysis, and No. 57634, a male, has exostoses on the right ilium in the region of the anterior superior iliac spine. Altogether the pelvis of 8 subjects or 8.8 per cent of all adult skeletons examined, including those in which the pelvic bones were not preserved, show signs of arthritic changes. In addition the sacrum of No. 58460, a young adult female, shows slight traces of periostitis.

Humeri. In two subjects the humeri show signs of moderate osteoperiostitis. In two other subjects the humeri show signs of arthritic changes.

Radii. Moderate osteoperiostitis was observed in three cases, both sides being affected in two of the subjects.

Ulnae. In No. 26592, a male, the left ulna presents a healed fracture, with little displacement and no signs of inflammation. In No. 57506, a male, both ulnae show signs of arthritis. Three other subjects show moderate to pronounced osteoperiostitis affecting both ulnae in two instances. In the third only the right ulna is preserved and the disease has affected the distal half of the bone.

Femora. Seven subjects show pathological changes in the femora. The left bone of No. 57506, a male, has a moderate "mushroom head." Both femora of Numbers 58371, 57636 (*a*), and 57571, all males, show signs of arthritis. In three other subjects moderate osteoperiostitis has affected the distal halves of the femora.

Tibiae. Thirteen subjects, or 13.1 per cent of all the adult and adolescent skeletons examined, exhibit pathological features in the tibiae.

Pronounced curvatures, probably due to a mild form of rachitis, occur in four subjects. In nine individuals inflammatory changes have taken place in the tibial shafts, ranging from slight localized periostitis to extensive osteoperiostitis affecting the entire shaft.

In No. 58371, a male, the left tibia shows a healed fracture accompanied by considerable inflammation affecting the distal portion of the shaft of the tibia, the astragalus, and the calcaneum.

Bones of the Foot. Except in the case noted just above, no pathological conditions were observed in the bones of the feet included in this series.

General Remarks on Pathology of the Bones. In connection with the above notes on the pathology of the bones in the Madisonville series, it is instructive to compare the results of Langdon's examination of 662 skeletons exhumed during the early years of excavation in the Madisonville site. (Langdon, op. cit., p. 247 et seq.) That author figures a spinal column in which

the spinous and articular processes of all the lumbar and dorsal vertebrae are fused, while the bodies remain free, with the exception of two in the lumbar region which are connected only by a thin band of osseous tissue. Several of the carpal and metacarpal bones are also united into a solid bony mass, and the atlas is connected with the skull in a similar manner. . . . The axis and the third cervical vertebra are also united by the coalescence of their bodies as well as of their transverse, articular, and spinous processes. The heads of the ribs are likewise ankylosed with the bodies of the vertebrae and their tuberosities with the transverse processes. (Op. cit., p. 249.)

He ascribed this condition to arthritis deformans.

Langdon also mentions

Arthritis involving a right shoulder joint, with flattening, enlargement and eburnation of the head of the humerus and glenoid fossa. (Op. cit., p. 253.)

The same author states that the pathological features presented by the tibiae include

Evidences of *periostitis*, *osteitis*, and *osteo-myelitis*, in varied combination; as well as *exostosis*, and an obscure form of rarefaction. (Op. cit., p. 256.)

In one specimen figured by him (fig. 14) he says:

The evidences of ulceration about the lower half of this bone are somewhat suggestive of *syphilitic* lesions which supposition is further strengthened by the bilateral character of the disease and the presence of several nodular excrescences distributed along the crest of the bone.

The suspicion as to existence of syphilitic lesions in the bones of this series arose in the mind of the present writer before he had referred to Langdon's report, and it was precisely the frequency

of serious bilateral inflammatory conditions in the tibiae that occasioned such suspicion. Probably these conditions were brought about by syphilis, but it is extremely difficult to distinguish between bone lesions due to that disease and those that result from the systemic conditions which prevail in osteoarthritis. On the whole the author does not feel qualified to make a positive decision in this matter on the basis of the evidence.

Arthritis and arthritis deformans were present, as were also periostitis and osteoperiostitis. Rachitis seems also to have been present in a mild form, although the only bones which showed it were tibiae. There is the possibility of a tuberculous condition in the spine of one individual, but here, again, the condition may be simply arthritic.

Fractures and injuries of the bones are rare, except in the skulls, of which the pathological and traumatic features have been discussed above.

General Summary of Observations. The characters of the Madisonville crania examined have been summarized above in some detail. In general they are three-fourths brachycephalic and the rest mesocephalic, with the exception of two dolichocephalic specimens. The height of the skull vault is somewhat low, but the cranial capacity is well up to the average for Indians. The faces are broad and very short, the orbits, low and broad, the nasal apertures prevailing platyrrhine, with poorly developed nasal spine and indistinct lower borders. There is little prognathism, and the jaws are short and broad. The mandibles are somewhat deficient in symphyseal height.

The femora indicate a stature of about 167 cm. for males and 155 cm. for females, which is a little above average for Indians but not tall. The long bones do not indicate especially pronounced muscular development, but about average for Indians. The limb proportions approximate to those generally observed in American Indians. Platymeria and platynemia are not pronounced except in individual cases.

The Madisonville crania are less strong and rugged than those of the Tennessee Stone Grave group and differ from them in many respects, but particularly in lessened height of the cranial vault, of the face, and of the mandible, in our series. The Tennessee group also contains a large majority of brachycephals. There is

little doubt that the Madisonville site was inhabited by a people in whom a preponderance of physical characters belonging to the southern and eastern brachycephalic group of Indians was united with an admixture of modified characters originating in the eastern dolichocephalic group. This group seems to have been the result of long contact rather than a primary mixture. Probably its physical affinities with groups, as yet unstudied, in Ohio and Indiana, are closer than with the Tennessee Stone Grave group, or with the Iroquois and other eastern groups.

CONCLUSION

BY CHARLES C. WILLOUGHBY

Period of Occupation of the Madisonville Site. It is evident from the foregoing pages that the occupation of this site covered an interval immediately preceding the first intercourse of the Indians of the region with Europeans, and extended into the protohistoric period, at which time the inhabitants were able to secure a small amount of European iron, brass and copper, together with a few glass beads, either directly from the early missionaries or traders, or indirectly through their Indian neighbors.

That these later inhabitants were of the same group as the earlier dwellers upon the site is evident from the finding of a cross and other trinkets of brass in a grave containing also a pottery vessel of a type common throughout this cemetery. The site, however, appears to have been abandoned long before the arrival of European settlers in the Ohio Valley.

Relation of the Madisonville Culture to that of the Surrounding Tribes. The Madisonville culture in prehistoric times extended over a considerable portion of southern Ohio. This is shown by the work of Mr. Mills of the Ohio State Archaeological Society, in Warren, Scioto and Ross Counties,¹ and by the explorations of the Peabody Museum in Hamilton County, but these sites were apparently abandoned at an earlier date than the one at Madisonville, for so far as the present writer has been able to learn no objects of European origin have been found associated with the burials or cache-pits in any of them. This seems to indicate a southern migration of the northern outposts of these Indians to the Ohio River not later than the first part of the Seventeenth Century, perhaps before the Miami took possession of this country. They were probably driven southward by the Iroquois.

¹ W. C. Mills, *The Gartner Mound and Village Site; The Baum Village Site; The Four Mounds and Village Site*; Papers of the Ohio State Archaeological Society, Columbus, Ohio.

In all treaty negotiations of the early settlers, the Miami were considered the original owners of the Wabash country in Indiana, and all of western Ohio, while the other tribes were regarded by them as tenants or intruders on their lands.¹ The Miami gave their name to the two principal rivers in southwestern Ohio. Mr. Mooney also states that

In 1684, the Iroquois justified their attack on the Miami by asserting that the latter had invited the Santanas (Shawnee) into their country to make war upon the Iroquois. This is the first historic mention of the Shawnee . . . in the country north of the Ohio River.²

With our present knowledge of the material culture of the proto-historic Miami and Shawnee we are not warranted in assuming definitely that members of either of these tribes were the makers of the artifacts found upon this site, or that their dead were buried here.

A few burial mounds were apparently built by the Indians of the Madisonville culture, as seems evident from the explorations of Mr. Mills at the Gartner and Feurt sites. It is possible that some of the mounds, formerly standing near the house circles and just outside the area shown on our plan (plate 30), which were excavated by Dr. Metz before the discovery of the cemetery, were the work of these Indians. It should be understood, however, that the people of the Madisonville culture undoubtedly belonged to a different group and were of a later period than the builders of the great earthworks of southern Ohio.

The few house circles at Madisonville were to the northeast of the cemetery. They were much larger than the hut sites found by Mr. Mills in the localities before mentioned. Those reported by him were mostly circular, without rings, and of a size and form corresponding to the houses in common use among the Algonquian tribes of the Great Lakes region within historic times, while those at Madisonville were forty to sixty feet in diameter, measuring from their outer edges, and more nearly approach the larger house circles of the Tennessee region to the south.

The few artifacts found during the investigations of these circles were in general of types corresponding to those of the main village.

¹ James Mooney and Cyrus Thomas, *Bulletin* 30, vol. i, p. 853, Bureau of American Ethnology.

² James Mooney, *ibid.*, vol. ii, p. 534.

It is possible, however, that these circles antedate the occupation by the people under consideration, and that the artifacts were the result of the later occupation of the ground. The absence of such circles on the main site, where, as indicated by the cache-pits, most of the cabins stood, would seem to point to this conclusion, but the data relating to the subject are too meager to warrant definite deductions.

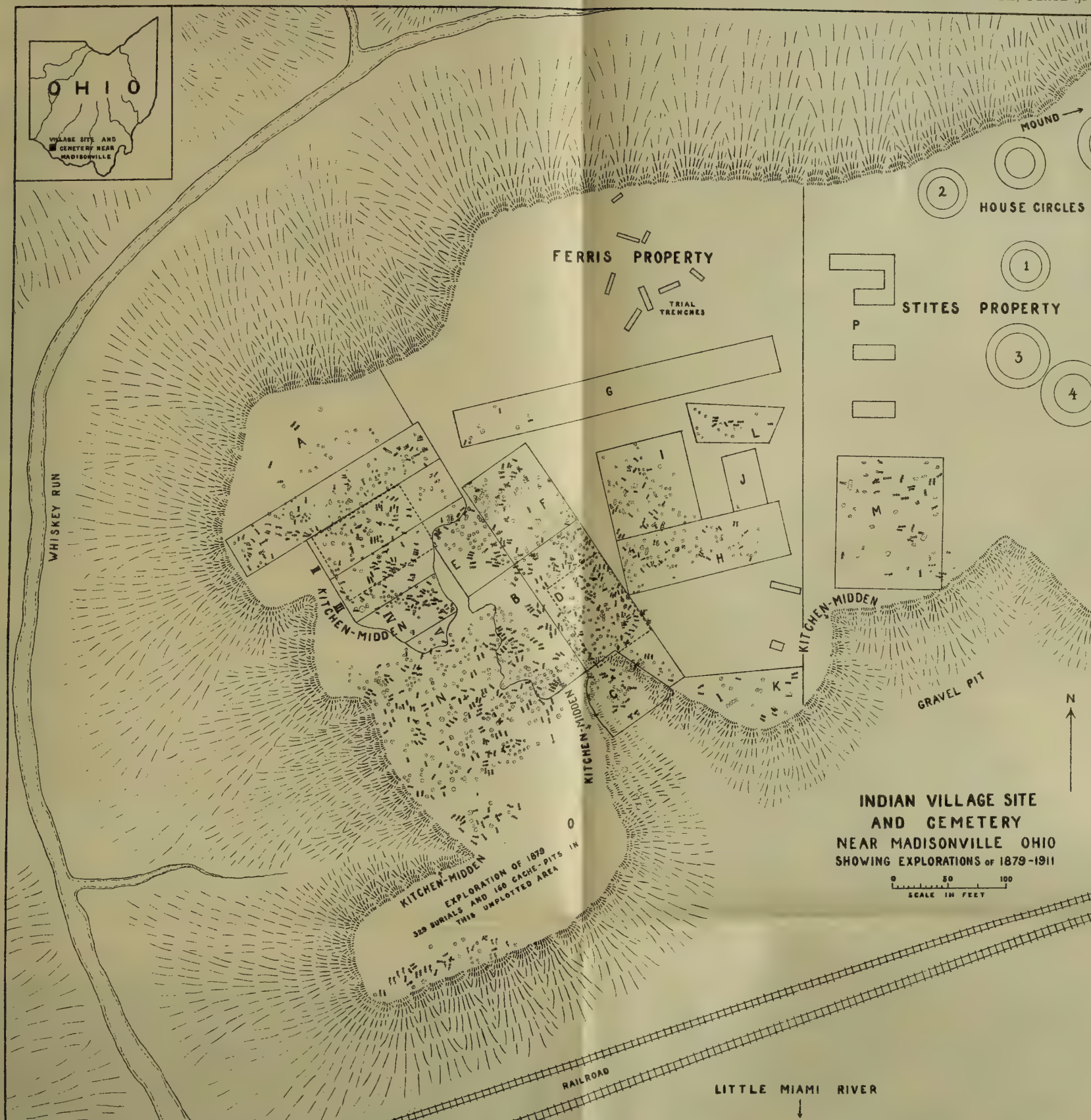
Speaking broadly, there is much to indicate that the more distinctive artifacts of the Madisonville and other similar sites of southern Ohio are in general more closely related to a group from an area some five or six hundred miles in diameter, having its center in northern Kentucky, than to those outside this region. So far as we know, tribes of the Algonquian stock held nearly all of this area at the time of the latest occupation of this site, but further archaeological investigations in the neighboring states of Indiana and Kentucky are necessary before definite conclusions can be drawn as to which branch of this stock probably dwelt at Madisonville.

Physical Relation of the Inhabitants to the Neighboring People.

Unfortunately there is little osteological material available from the two states above mentioned for comparison with that of Madisonville, and the skeletal remains from the mounds and graves of the Great Earthwork Builders of Ohio now in the Museum have not been systematically studied.

Certain quite marked differences between the Madisonville people and the Stone Grave Indians of Tennessee have, however, been pointed out by Dr. Hooton (page 133), whose careful work upon the physical characteristics of these two groups forms a substantial and reliable basis for future comparative studies in connection with human remains from the adjacent regions.

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- I-V Peabody Museum Explorations, 1897, J. R. Swanton, Field Director
A-C " " " 1907, R. E. Merwin, " "
D-F " " " 1908, " " " " "
G-K " " " 1911, B. W. Merwin, " "
L " " " 1882, F. W. Putnam, " "
M Dept. Anthropology Exp., 1891, World's Columbian Exposition,
C. L. Metz, Field Director
N Madisonville Literary and Historical Society, Cincinnati Hist.
Soc. and Peabody Museum Explorations, 1880,
C. L. Metz, Field Director
O Madisonville Literary and Historical Society, 1879,
C. L. Metz, Field Director

P Trial Trenches, 1882

1-4 House Sites

Owing to the small scale of this plan, some of the minor burials, smaller cache-pits, post-holes, etc., are omitted, to add clearness to the grouping of the more important interments and pits.

Detail plans on a larger scale are given on plates 1 and 2 of portions of Trenches II and III and the greater part of Trench D. The positions of these enlarged areas are indicated on the plan by rectangles enclosed by broken lines.

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PAPERS

OF THE

PEABODY MUSEUM OF AMERICAN ARCHAEOLOGY
AND ETHNOLOGY, HARVARD UNIVERSITY

VOL. VIII. — No. 2

BASKET-MAKER CAVES OF NORTHEASTERN ARIZONA

REPORT ON THE EXPLORATIONS, 1916-17

BY

SAMUEL JAMES GUERNSEY

AND

ALFRED VINCENT KIDDER

*FORTY-FOUR PLATES AND SIXTEEN ILLUSTRATIONS
IN THE TEXT*

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INTRODUCTION

IN the summer of 1914 the Peabody Museum of Harvard University sent an expedition to northeastern Arizona under the joint leadership of the present authors for the purpose of studying the relations between the cliff-houses of that district and those of the north side of the San Juan River. In the course of this trip, evidence was found of the presence of the Basket-maker culture. This culture had hitherto only been reported from a single rather restricted area in southeastern Utah.¹ Furthermore, no Basket-maker remains had ever been taken out by trained investigators; so that the claims, put forward by the commercial collectors who discovered and named the culture, that it was a distinct one, antedating that of the Cliff-dwellers, had been received by archaeologists with more or less incredulity. We felt, therefore, that the opportunity for studying these little known remains in a region untouched by earlier diggers, was one which should not be neglected; all our subsequent work has accordingly been directed toward the finding and excavation of Basket-maker sites.

In 1915 the junior author regretfully gave up field work in this region to undertake other excavations, and the expeditions of that and the following years were conducted by Mr. Guernsey. The results of 1914 and 1915 have already been published,² the present report deals with the explorations of 1916 and 1917; at the close of the latter season field work was temporarily discontinued because of the war. In each year the expeditions were carried on under permits granted by the Secretary of the Interior.

The Museum wishes to make grateful acknowledgment to the following persons whose generous contributions, supplementing the Museum appropriation, served greatly to enlarge the scope of the work: Mrs. S. K. Lothrop, and Messrs. Bronson Cutting, Lawrence Grinnell, F. E. Guernsey, Augustus Hemenway, Henry Horn-

¹ Pepper, 1902. The existence of the Basket-makers was first pointed out in print by Dr. T. Mitchell Prudden in *An Elder Brother to the Cliff-dwellers* (Prudden, 1897).

² Kidder-Guernsey, 1919.

blower, J. M. Longyear, D. L. Pickman, and John E. Thayer. It wishes also to tender its thanks to Professor Byron Cummings of the University of Arizona, who unselfishly shared with it the field in which he was the pioneer; to Clayton Wetherill for his enthusiastic and faithful services as guide and interpreter; and to Mr. and Mrs. John Wetherill and Mr. Clyde Colville of Kayenta for their unfailing hospitality and constant helpfulness.

In the two seasons covered by this report, the party outfitted at Farmington, New Mexico, and proceeded by wagon and horseback to the trading post of Wetherill and Colville at Kayenta, the base from which further explorations were conducted. Kayenta, which may be found on the more recent Government maps, is reached from Farmington by a journey of four to five days, depending on the condition of the stock, and the abundance of grass and water. The caves and ruins described all lie in Arizona within a radius of one day's ride from Kayenta.

The country exerts a charm which the authors confess their inability to describe. Its physical aspect has already been noted by more competent writers;¹ it is sufficient for the purpose of this paper to say, that although essentially a semi-desert region, there is no difficulty now, nor was there ever, apparently, in earlier times for the dweller here who understood the environment, to obtain sufficient sustenance for simple requirements. The wastes of the valleys and mesa tops that once supplied the wild game with which the early people supplemented the fruits of their agriculture, now furnish ample grazing grounds for the Navajo's flocks of sheep and goats; these Indians also succeed on selected sites in producing good crops of corn, under conditions that to a white farmer would seem quite impossible.

CAMBRIDGE, MASSACHUSETTS

March 5, 1921

¹ Prudden, 1903, pp. 282-285; and 1907; Gregory, 1916, pp. 45-67.

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BASKET-MAKER CAVES OF NORTH- EASTERN ARIZONA

REPORT ON THE EXPLORATIONS OF 1916-17

FIELD WORK, SEASON OF 1916

THE plans of the 1916 expedition included the investigation of a Cliff-dweller ruin discovered the previous year on the west bank of the Chinlee, one day's journey east of Kayenta.¹ A week was spent here. After reprovisioning at Kayenta, camp was made near the mouth of Yellow Head Canyon, about 10 miles to the west, where two days were occupied in examining a small cave and in studying cliff-dwellings that had been cleared by Professor Cummings in 1914. Sunflower Cave (see map, figure 1) a site left unfinished in 1915, was then visited with the object of further investigations.² The remainder of the season was occupied in exploring the South Comb and in excavating two caves some 5 miles north of Sunflower Cave.

THE SOUTH COMB ³

The South Comb is a great sandstone monocline that extends from Marsh Pass in a generally northeastern direction as far as the San Juan River. About 16 miles from Marsh Pass its continuity is broken by a narrow valley which leads through it from Kayenta to the Agathla Rock. Our work was confined to that section lying between the break and Marsh Pass.

Hereabouts the course of the Comb is sinuous and its appearance constantly changing; some stretches are tilted steeply toward the sheer walls of Skeleton Mesa, whose top at those points rises higher than the jagged summit of the Comb itself, which is shown in plate 1, b. Other stretches show gentle inclines that seem to lead to the Mesa, but on reaching the crests the way is invariably blocked by deep intervening chasms. It is hard to imagine more

¹ To be described in a separate article.

² For the location of this and other sites, see map, figure 1.

³ For the geology of the region, see Gregory, 1916, p. 47.

rugged rock formations than those to be found in this part of the Comb. Frequently, and with little strain on the imagination, one can make out along its crests weird forms in natural sculpture: the outlines of colossal animals, faces, solitary spires and minarets, whose silent grandeur at nightfall intensifies the brooding gloom of



FIGURE 1

Sketch-map of the Kayenta Region.

the desert. In the walls of the tortuous gorges that wind up among the cliffs are countless caves, large and small, many of them so well hidden among the contorted rocks that they can be found only by working one's way on foot along the ledges.

Before exploring for new sites, the expedition occupied itself with two caves found in the Comb during the previous year.

Sunflower Cave Revisited. While work at this site was still in progress in 1915, a sudden flood in Laguna Creek cut off communication between the camp, which lay on the east bank, and the ruin. As time was very limited, it was thought best not to wait the several days that it would probably take for the water to subside; and the party moved on, leaving a section at the rear of the cave unexplored.

Sunflower Cave was occupied by a small cliff-house in which was found the remarkable cache of ceremonial objects that gave the place its name.¹ Of even greater interest, however, was the presence of certain remains which led us to suspect that in this cave might be found evidence as to the relative age of the Basket-maker and Cliff-dweller cultures. Cist 4, sunk into the hard-pan behind the cliff-house rooms, had given the most positive indications of this; it is described as follows in the previous report (p. 96):

The outlines of this cist could be traced by a disturbed area showing in the face of the trench. It had originally been a stone enclosure, though but two of the slabs were still in place. A few bones of a child were found in the upper part; near the bottom at the side nearest the back of the cave were two decorated bone tubes. Imprints of coiled basketry could be seen in hard lumps of the adobe filling, but nothing of the basket itself remained. The cist gave us the impression that it had been a Basket-maker burial chamber which had been pulled to pieces, partly emptied and then filled in with rubbish during the cliff-house period.

There was also found in the loose rubbish a typical Basket-maker sandal, the presence of which, in what was a purely cliff-house site to all outward appearance, required some explanation.

We were accordingly very anxious to examine the still undug portions at the rear of the cave. The results of the second visit amply repaid the effort, for we discovered unmistakable stratigraphic evidence of a sequence of occupation. The new excavations revealed Basket-maker burials, some of them entirely undisturbed, below a stratum of typical Cliff-dweller debris. The location of the finds is shown on the plan (figure 2); their relation to the Cliff-dweller remains is clearly brought out in the diagrammatic cross-section (figure 3).

Cist 5 (cists 1 to 4 opened in 1915) was a shallow bowl-shaped hole dug in the hard-pan. In it were parts of the skeletons of a young

¹ For a general description of this cave and of the finds made there in 1915, see Kidder-Guernsey, 1919, pp. 92-96.

child and an adult, while scattered through the loose dirt about the top were portions of the skeleton of a second child, which had probably originally been deposited with the other remains. The bones

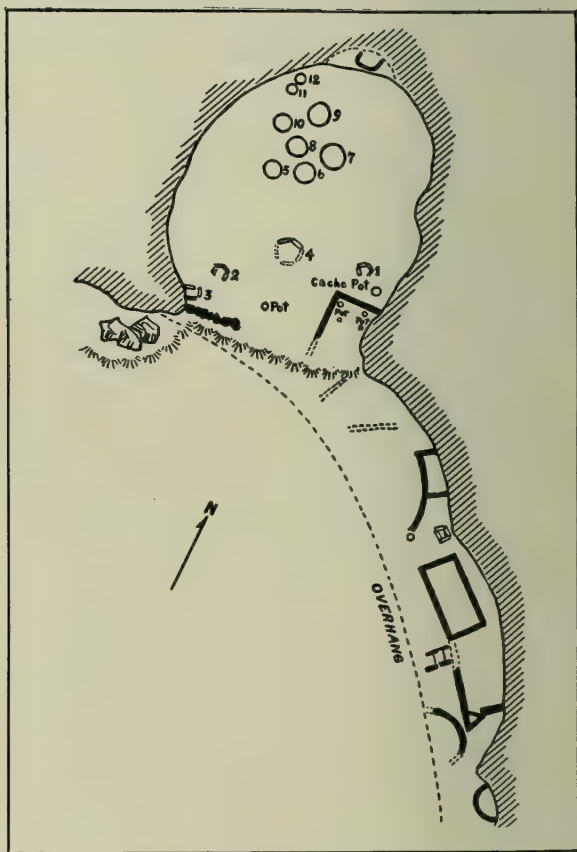


FIGURE 2
Plan of Sunflower Cave, South Comb.

of the adult had been carefully disposed at the bottom of the hole, in a manner to make the most of the limited space. They consisted of an undeformed skull in good preservation, the long bones of the arms, the scapulae, and a few ribs and vertebrae. The arm bones were placed on either side of the skull, the other bones

being packed close about it. Lying across the arm bones was a section of a femur which showed a long splintered post-mortem break. The lower jaw was found in the loose rubbish some fifteen inches from the edge of the cist.

It had probably been dragged out by rats, a thing we found to be not uncommon in caves. A small white chipped point lay among the bones. Above these remains was the disarranged skeleton of the young child. The second child's skeleton as before stated, was scattered through the loose earth about the cist. We

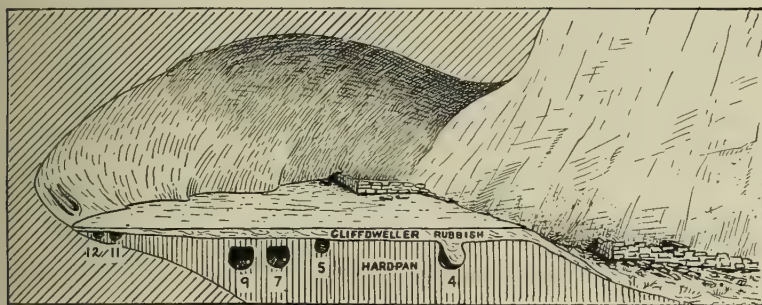


FIGURE 3
Sunflower Cave, Cross-section.

are at a loss to account for the neat arrangement of the adult bones. It is clearly a case of secondary burial, but we have never found any instance of this practice in undisturbed Basket-maker sites, and the people who looted Basket-maker graves did not, as far as we are aware, ever trouble themselves to restore anything to place.

Cist 6 was 2 feet 6 inches in diameter and was cut 3 feet deep into the hard-pan. It lay 4 feet east of Cist 5, and contained only a quantity of loose cedar bark and shredded grass piled in the bottom. It is possible that the bones found in Cist 5 came from here, though no positive evidence remained that it had been used for burial.

Cist 7 was an untouched Basket-maker grave; the original filling passed unbroken above it, and was in turn overlaid by Cliff-dweller rubbish (figure 3). It was 4 feet in diameter, 3 feet deep, and held the well-preserved skeletons of two adults with undeformed crania. They lay flexed on their left sides, hands between the lower thighs (plate 10, c); over the head of each was inverted a small coiled basket, one of which can be seen in the photograph. The

earth about the skeletons showed traces of decayed organic matter, probably from fur-string robes and other wrappings; rotted cedar bark was found at the bottom. The only object besides the decomposed baskets was a small strip of bark with one end neatly trimmed off.

Cists 8, 9 and 10 had all been plundered in early times and contained only fragmentary skeletons; a number of cylindrical seed beads accompanied the remains of a child in Cist 10.

Cists 11 and 12 were within 3 feet of the rear wall of the cave. Although very close under the surface they had not been molested. Cist 11 was a shallow bowl-shaped scoop in the hard-pan, and held two infants. One of these had been wrapped in a fur-string blanket and lay on what seemed to be a twined-woven cedar-bark mat, beneath which was a reed-backed cradle too badly rotted to preserve. Infant 2 was also wrapped in a fur-string blanket and lay on a decayed reed-backed cradle; near the head were remains of a coiled basket inverted over traces of a substance resembling meal. Both cradles were of the rigid type shown in plate 20. Accompanying the bodies were two bark objects covered with prairie-dog skin, which we have since been able to identify as umbilical pads. Cist 12 was a small hole in the hard-pan. In it was an infant wrapped in a fur-string robe and encased in a twined-woven bag. The robe had been destroyed by insects, but the bag was in a fair state of preservation.

All the above Basket-maker cists lay below a layer of cliff-house rubbish from 6 to 8 inches deep, made up of ashes, turkey droppings, bits of straw and many potsherds of the same wares as those found on other cliff-house sites in this region. Beneath this rubbish, the surface of the hard-pan above the cists gave no indication of their presence, being as compact and of the same appearance as the surrounding hard-pan. If, therefore, we had followed the 1915 method of clearing and examining the Cliff-dweller rubbish down to the hard-pan, and not cutting into it except where the tops of cists were encountered or other surface indications excited interest, these burials would have escaped notice altogether.

Fortunately, however, the trench was run much deeper than usual and entered Cist 7 from the side. The section thus exposed showed the top to be filled to a depth of 1 foot with a compactly tamped mass exactly like the hard-pan in which the cist itself was



SOUTH COMB

a, White Dog Cliff and Navajo Hogan; b, South Comb, near White Dog Cave.

excavated (figure 3). That the infant burials in Cists 11 and 12 remained undiscovered through the period of Cliff-dweller occupancy is remarkable, since they were covered by hardly more than 3 inches of the cave earth; the Cliff-dweller rubbish here was also very thin. A possible explanation may be that this part of the cave was used by the Cliff-dwellers for storage or for sleeping places, and was thus in a measure protected from the random digging to which the more open portions were exposed.

Had the Cliff-dwellers, the final tenants of the cave, been more persistent in their search, there would have remained no trace of the Basket-maker period except the cists, empty or refilled with Cliff-dweller rubbish. Attention is called to this for the sake of emphasis, as further on in this report, caves are described where all evidence of Basket-maker occupancy other than the empty cists has been effaced.

Goat Cave. This site was located by the expedition of 1915. It lies about two miles north of Sunflower Cave at the foot of a steep incline leading to the top of the Comb (see figure 1). The approach is through a narrow ravine choked with great rocks, among which a thick growth of large old cedars has found root. These trees screen the place from view except at a few points in the ravine. The cave is a deep shelter at the west end of which is an even deeper recess. As shown in the plan (figure 4) there are two levels: a front or lower one, extending the entire length of the cave; and a higher rear level, consisting of the whole floor of the inner recess and of a narrow gallery running all along the back of the more open part of the cave. The whole upper level is formed of the original hard-pan fill; along the gallery or terrace this breaks away in a vertical bank. The walls and roof of the cave are much blackened by smoke. At one point in the rear of the cave the floor is covered by a thick layer of ashes and charcoal. In the recess and on the end of the gallery next to it, are a number of partly fallen walls (plate 2, a, b).

Room 1, five feet in diameter, the walls 2 feet 4 inches high, is built of upright slabs of stone.

Room 2, from the foundations that remain, appears to have been oval in shape. From front to back it measured 8 feet, its length could not be determined as the end wall had disappeared. The foundation is of thick stone slabs of uniform size set on end, on

these small stones were laid flat (plate 2, a), but little of the upper course remained in place. Joints between the foundation slabs were closed with adobe mortar. The upper courses appear to have been chinked with the same material. Back of this room are remains of two curved walls built of coursed masonry in the usual Cliff-dweller manner. Stone apparently from these walls was used to construct a small cairn on the opposite side of the recess. It

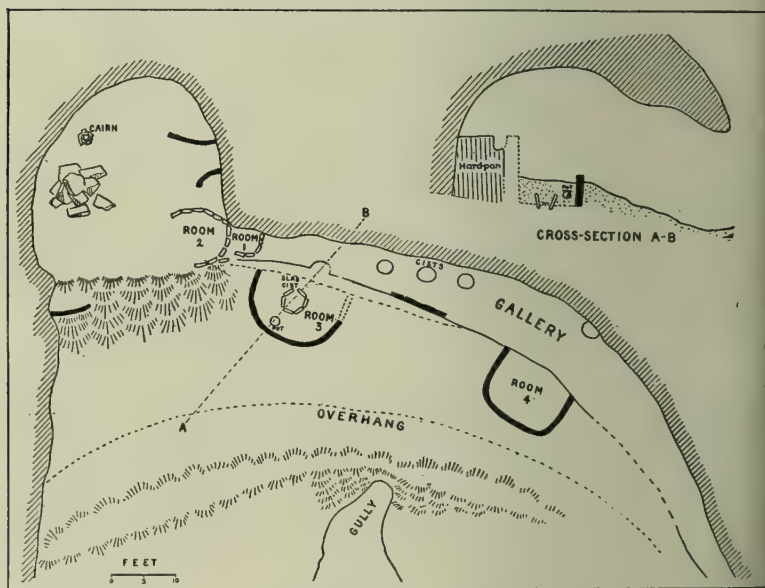
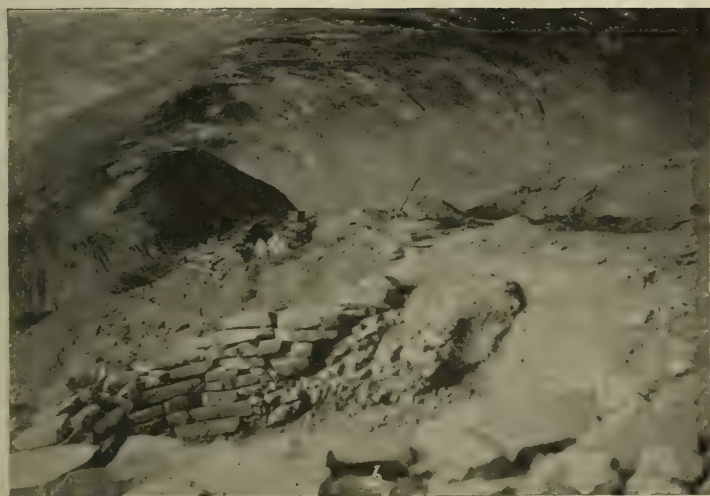
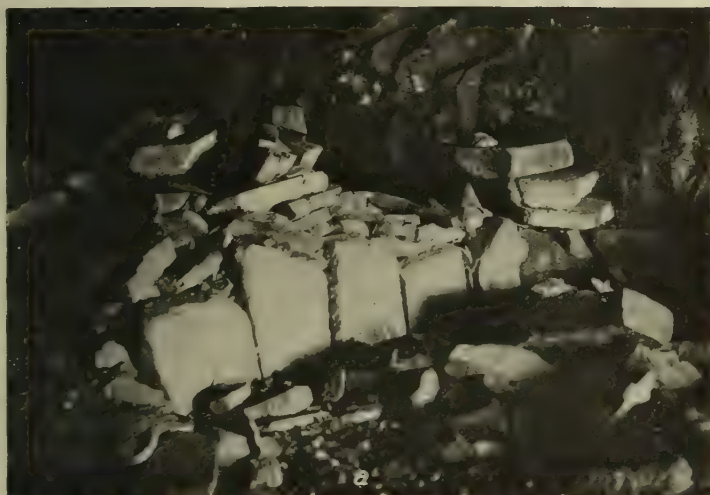


FIGURE 4
Plan and Cross-section of Goat Cave, South Comb.

resembles monuments built by the Navajo to mark water or trails; nothing was found beneath it. Directly in front of the cairn is a heap of rocks fallen from the roof of the cave.

On the lower level in front of the gallery are two roughly circular rooms which we at first wrongly thought to be Cliff-dweller kivas, but they were found to contain none of the special features of ceremonial rooms. Both were built against the steep bank of the terrace which had been cut away to form their rear walls.

Room 3, the less well-preserved of the two, measured 15 feet across its greatest diameter; the wall stood 4 feet at its highest



GOAT CAVE

a, Slab foundation of Room 2; b, General view, Room 3 in foreground.

point. The masonry is interesting and unusual; medium-sized flat stones are laid up without any mortar in such a way as to produce an even surface on the interior (plate 2, b), the exterior being left irregular and rough. So carefully are the stones placed that in spite of the absence of mortar the construction is firm and solid. In clearing this room a slab cist was uncovered, measuring 4 feet in diameter at the top, 3 feet at the bottom, and 2 feet deep; in the bottom was a 2-inch layer of ashes and charcoal and over this 2 inches of cedar bark. It was very similar to Basket-maker slab cists found in Cave 1, 1915.¹ The original floor of Room 3 was so ill-defined that we could not determine exactly the relation of the cist to the floor, but as near as could be judged the upright slabs had been sunk into it a depth of about 8 inches.

Cached in the loose filling of the room, at the point indicated in the plan (figure 4; note also its position in the cross-section) was a black corrugated olla. It was covered with a thin flat stone, but contained only drift sand.

Room 4. The general shape of this room is shown in the plan. Its greatest diameter, measured inside, is fourteen feet, from back to front eleven feet. The highest point in the wall, five feet, is probably the original height, as no loose building stones were noticed here. No trace of roofing remains. The masonry wall has no sharp corners. The back wall is cut in the face of the gallery and has a slight bend or angle. The stones are laid to produce a smooth face on the inside as in Room 3, and with considerable skill, since they are still firmly in place though there is no trace of adobe mortar in the joints. In excavating the room we found quantities of charcoal and scattered bundles of cedar bark, but no artifacts. Two rude cists lined with cedar bark were also opened. As in Room 3 the floor was not well-defined.

In the floor of the gallery were several jar-shaped cists dug in the hard-pan (see figure 4). These were exactly like the burial cists found in the Sayodneedchee burial cave, 1914.² At a point back of Room 3 where the terrace wall had caved off carrying with it one half a cist (see section in figure 4) the exposed cross-section showed plainly the marks of digging sticks in the side of the cist thus brought to view. Two of the cists contained a few human bones;

¹ Kidder-Guernsey, 1919, p. 77 and plate 27.

² Ibid., p. 28 and figure 8.

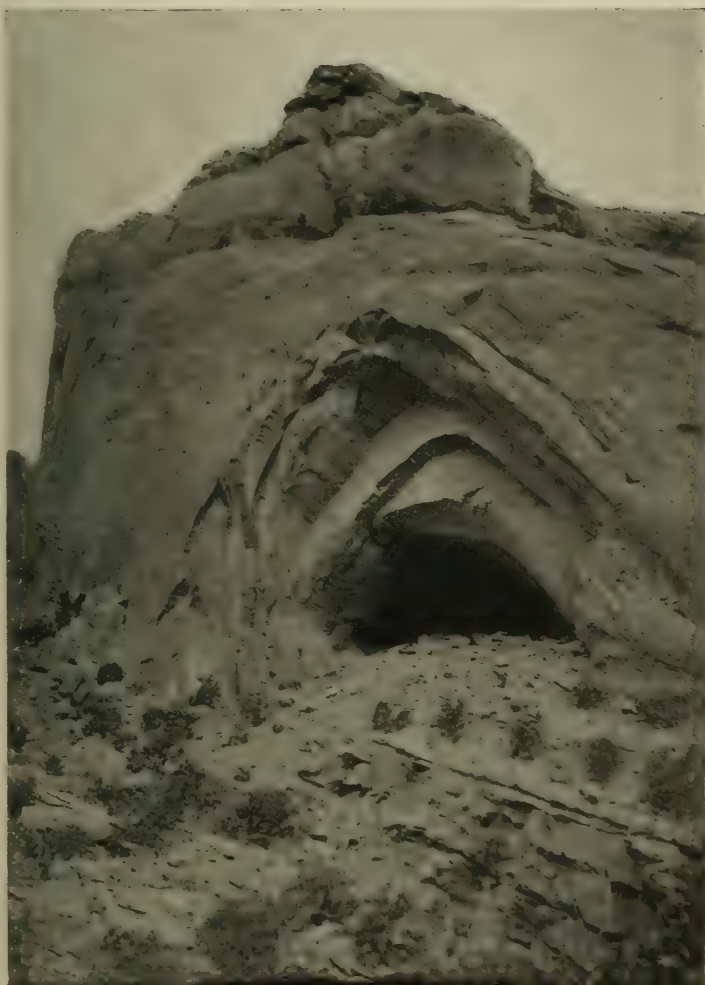
while other portions of skeletons, some bleached by long exposure, were found in the loose sand covering the floor of the terrace. These were, no doubt, plundered Basket-maker burials.

The authors wish to call particular attention to the rooms uncovered in this cave. Their masonry, with the exception of the single wall in the recess, is quite different from that of the cliff-dwellings.

White Dog Cave. This was by far the most prolific site discovered by the Museum's expeditions to northeastern Arizona. Its position is most inconspicuous and the first view of it was obtained during a climb high up among the rocks of the Comb, the only place in fact, from which it could be seen from any distance. It might easily have escaped notice altogether, for a rider passing along the valley below would not be tempted to explore the narrow ravine leading up to it, particularly as the cliff in which it is located is apparently in full view and seems to be entirely unbroken (see plate 1, a). One short section of the cliff is, however, out of sight from the flat land, and just there is tucked away the cave. The above conditions are described thus at length in order to show the absolute necessity of a careful search *on foot* among all the little side canyons of this broken country.

The approach is up a tortuous ravine. Arriving below it the visitor is astonished that so great a cavern should be so effectively hidden. It occupies a commanding position in the rounded front of a buttress-like swell of the cliff. The huge portal, 120 feet across the base and at least 125 feet high, seems carved by nature to conform to the dome-shaped top of the cliff above it. The accompanying photograph (plate 3), aside from having in it no familiar objects by which relative proportions may be judged, shows so clearly the process of formation and general aspect that further description is unnecessary.

Reaching the cave after a stiff climb of 100 feet up a steep talus, one enters a spacious chamber measuring approximately 70 feet from back wall to line of shelter and 120 feet across the opening. The ceiling is high and arched, the floor rises at an easy grade from front to back. Somewhat more than half the floor space is covered by large rocks fallen from the roof, one of which measures 20 feet in length, 12 feet in width and 10 feet thick (figure 5 and plate 11, a). This and other rocks near it we found later had fallen since the



WHITE DOG CAVE.

cave was occupied. The unencumbered portion of the floor was composed of clean sand and small broken stones. Although we subsequently unearthed considerable accumulations of ashes and charcoal in different parts of the cave, the walls and ceilings showed not a trace of soot, having been scoured clean by wind-blown sand. A demonstration of this process was furnished one day when a high wind from the proper quarter created a veritable

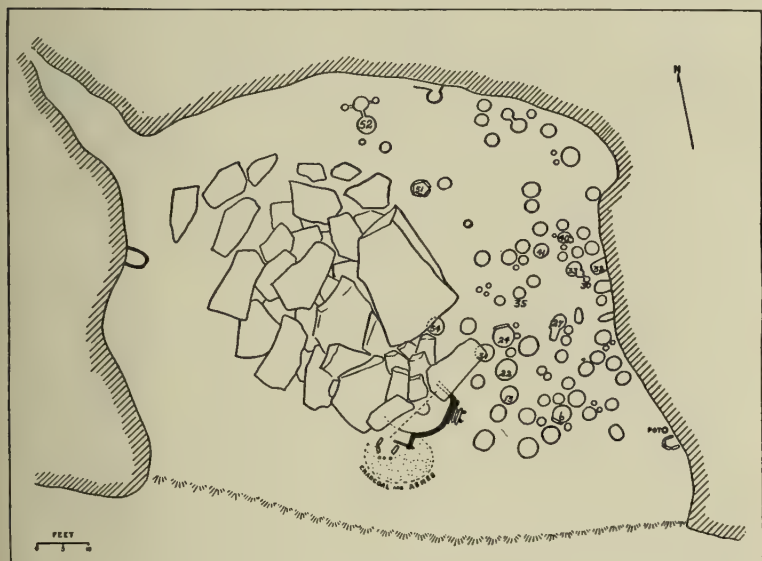


FIGURE 5
Plan of White Dog Cave, South Comb.

whirlwind in the cave, gathering up the surface sand and swirling it about in such quantities that we were forced to abandon work while it continued. A piece of paper released at the back would sometimes make as many as three complete circuits of the cave clinging close to the wall except as it passed across the front. On mentioning this to Mrs. Wetherill we were told by her that the place was known to the Navajo as the Cave of Winds.

The first examination of the cave for traces of occupation showed at the back against the wall the tops of several sand-filled cists, dug in the hard-pan. Searching the surface, a few bleached

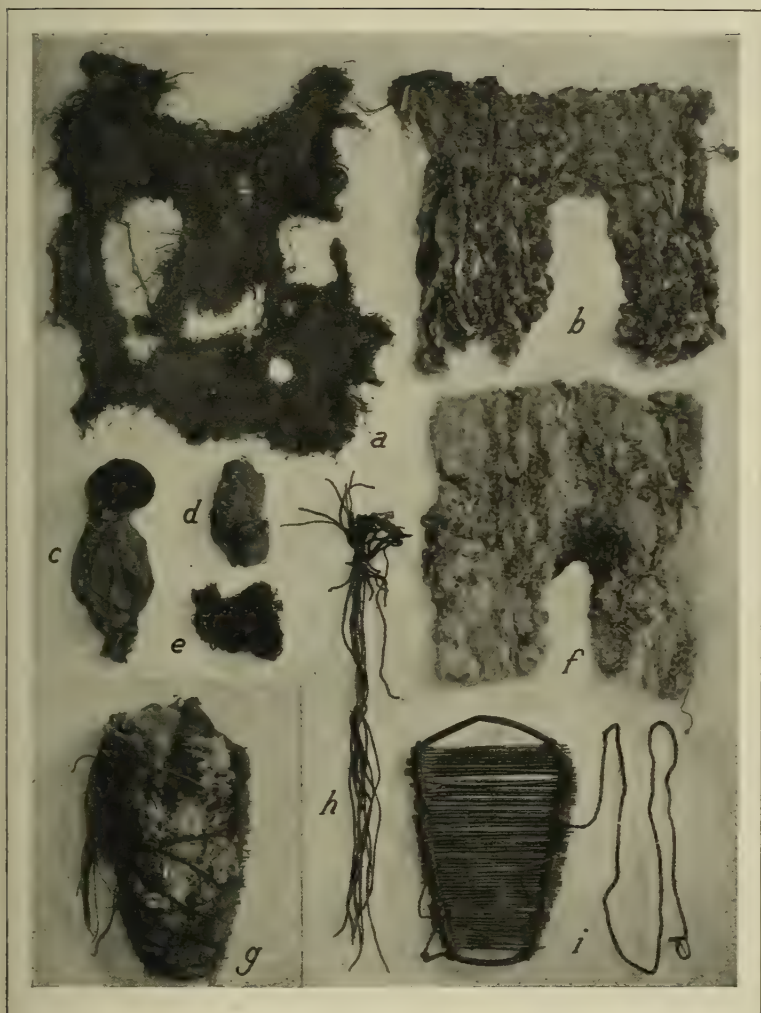
human bones were seen and a small handful of Cliff-dweller potsherds was picked up. Digging at random with a trowel, a few fragments of basketry and some bone beads were found. Near the center of the cave the ends of two upright stakes were noticed, projecting from 2 to 3 inches above the surface. Not until our second and more thorough examination did we discover on the west side a low foundation wall mudded on to the sloping rock floor of the cave. This was apparently the beginning of a small Cliff-dweller storage room or bin. As a "prospect" the cave fulfilled every requirement. Its exploration yielded a collection which fully represents most phases of the material culture of the Basket-makers.

Across the front of the cave where work was commenced there was found a natural ridge of coarse *débris*, back of which the sand fill had accumulated above the hard-pan floor to a depth of from 5 to 7 feet. Toward the back this deposit grew shallower until along the rear wall the hard-pan cropped to the surface.

The fill carried no refuse pockets or well-defined rubbish layers such as are found marking floor levels in Cliff-dweller caves. In general it was made up of a surface layer 6 inches to 1 foot deep of drift sand, below which it was composed of sand and bits of stone mixed with straw, pieces of bark, and particles of charcoal.

Occasionally there appeared thin strata of coarse charcoal and in certain areas there were encountered quite extensive accumulations of ashes and charcoal. In the general digging a number of specimens were found at various depths. They consisted mainly of basket sherds, fragments of fur-string blankets and tattered bits of woven bags; a mummified foot and other fragments of human remains were also recovered. All other objects were taken from cists.

In the plan, figure 5, are indicated a large number of cists grouped along the east wall; there were no cists on the west and north sides. The majority of these were jar-shaped excavations in the hard-pan ranging in size from small pot-holes 1 foot in diameter and of about the same depth, to examples 5 feet deep and 4 feet 6 inches in diameter. Some burials were found in this type of cist but for the most part they were empty, save for sand or sometimes cedar bark and grass at the bottom. Most of the burials were in the front half of the cist area. A few, as was just stated, were in



WHITE DOG CAVE

g, Cradle bundle as found. The other figures show cradle and contents unwrapped.

a, Woven cloth; *b*, *f*, Fur cloth blankets; *c*, Mummy of child; *d*, Umbilical pad;

e, Absorbent bark; *i*, Cradle. (About 1/12.)

cists completely excavated in the hard-pan, others were in shallow excavations in the hard-pan with one or two stone slabs so placed as to hold back the loose sand, and a single burial was in a cist (51) of the stone slab type described in the previous report.¹ Some of the burials had been previously disturbed,² but a number were found intact, the remains and mortuary offerings in a remarkably fine state of preservation.

In the account of the excavations which follows, certain cists and burials are described in detail. The intention is to present the salient features of the more typical ones, hence many small objects found in the cists or concealed among the wrappings of the mummies are not enumerated. They are, however, described in detail in another section.

Cist 6 (figure 6, a). The first burial cist to be encountered measured 3 feet in diameter, 2 feet in depth and was 4 feet below the surface. It represents a type that was evidently constructed primarily for sepulchre. At one side was an upright stone slab. Although the cist had been relieved of a good portion of its contents by ancient diggers we obtained from it a collection which required 51 catalogue numbers to record. In the upper part were the scattered bones of three infants; at the bottom a few bones from the skeleton of an adult. In the loose fill were several bunches of human hair (plate 32, c, d). A quantity of human hair evidently from the head of a mummy³ that had been pulled from the cist was also found in the loose fill. One small strand was wrapped about with a leather thong. Later we found in another cist a mummy with coiffure intact, having a queue-like strand wrapped in the same manner. These were practically all the human remains that were left. At the bottom against one side were a quantity of piñon nuts, the rotted remains of woven bags, loose beads, basket sherds, pieces of woven bags and fur-string robes.

Cist 13, a shallow bowl-shaped excavation, contained the remains of two infants. One, a very young child wrapped in two fur-string blankets and a fragment of woven cloth, was lashed

¹ Kidder-Guernsey, 1919, p. 77 and plate 27.

² This grave looting so commonly found in Basket-maker cave cemeteries is not modern. Although we have no direct evidence in its support, our theory is that it was the work of the Cliff-dwellers. See Kidder-Guernsey, 1919, p. 84.

³ The mummies were, of course, not artificially preserved in any way; they are merely desiccated bodies.

tightly to a small reed-backed cradle; an umbilical pad was in place and the dried umbilical cord was tied to one of the blankets. This mummy bundle as found, and also unwrapped so that all its parts can be seen, is shown in plate 4. The second body, that of a child about 4 years of age, was completely encased in a woven bag¹ (plate 30, f). It was also shrouded in a fur-string robe. Beneath this bundle were pieces of a cedar-bark mat, and over it was spread a fur-string blanket (plate 16, a) which was in turn covered by an

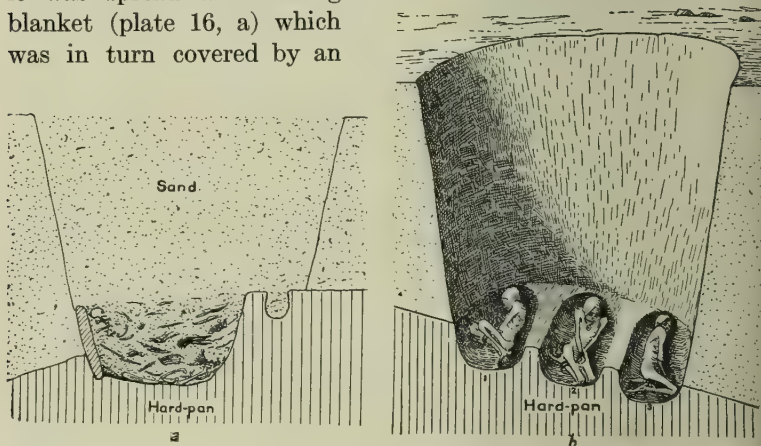


FIGURE 6

White Dog Cave: a, Cross-section of Cist 6; b, Cross-section of Cist 22.

inverted tray basket. At one side of the cist was a bowl-shaped basket also inverted. In the fill some 8 inches above the tray basket was a skin bag containing shelled corn (plate 15). At one side of the cist lay an atlatl in perfect condition save that before being placed in the cist it had been bent nearly double. This and the baskets are illustrated *in situ* in plate 10, e.

Cist 22 contained the bodies of three individuals. Its shape was roughly circular, the greatest diameter being 5 feet 2 inches, depth 2 feet 10 inches; the top was 5 feet 6 inches below the surface. Each body occupied a shallow depression scooped out of the bottom of the cist as shown in figure 6, b. The remains were partly mummified though not in a good state of preservation. The heads,

¹ The design on this bag is shown in color in plate 28.

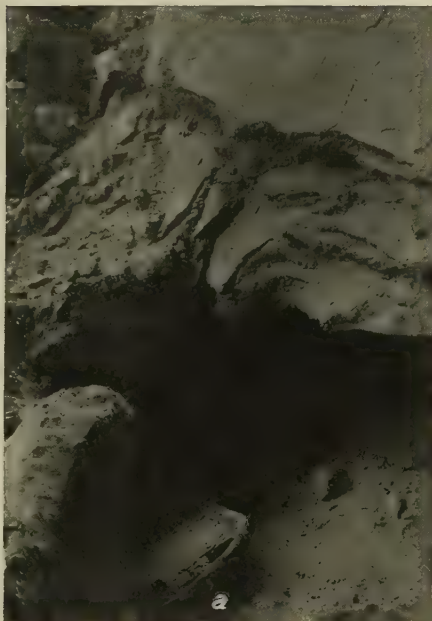
however, retained their hair and much of the dried tissue of the face. Each body had been wrapped in a fur-string blanket and sewed up in woven bags, all of which were in an advanced state of decay.

Number 1, the body of a young female, lay on its right side, knees drawn up and hands between the thighs. A skein-like rope of human hair was wound around the left forearm, passed between the thighs and made fast about the right leg below the knee. At the waist were fragments of a string apron. Some portions of bags that had been used to cover the body remained. A fragment at the feet was of very fine weave while pieces adhering to the knees were much coarser. Covering the whole were two tray baskets. Number 2 was a female. Three baskets were used to cover the body. It rested on its back with head and legs inclined to the left; the feet were drawn up close to the body; the upper legs, bent at the hips, were at right angles to the torso. The hands were in front of the lap, and were bound together at the wrists by fourteen turns of a tightly twisted cord of human hair. This cord was then knotted to a skein-like rope of human hair and both rope and cord passed through between the thighs and about the lower legs above the ankles. At the waist were remains of a string apron and on the breast lay a disk-shaped pendant of shell, ornamented with incised lines. About the neck were beads of olivella shells and thin disk-beads cut from shell, together with part of the leather string by which they had been suspended. In the bottom of the cist under the body were a number of dice-like stones and a single corn cob. Number 3 (male, 20 to 25 years of age) rested on its left side, limbs loosely flexed, hands between thighs. Two tray baskets covered the body. At the right side lay a grooved club, at the feet were a pair of badly rotted square-toed sandals with leather tie-strings and a quantity of small deer or antelope hoofs. Near the hoofs were two handle-like bone objects with small stones attached to their ends. About the neck was a string of shell beads. Among the objects found under the body was a fine chipped knife blade (plate 35, k) and its shrunken wooden haft.

Cist 24 held the mummies of two adults, one male and one female, each accompanied by the remains of a dog, and an unusual number of mortuary offerings. The remarkably fine state of preservation of everything in this cist is due to the fact that the burials were surrounded by dry sand. The excavation in the hard-pan made

to receive the bodies was a shallow hole just deep enough to hold them. As in Cist 22, each individual occupied a scooped-out place in the bottom of the cist. At the back was an upright stone slab; as none were used at the front or sides, its purpose was evidently to hold back the loose sand while the hard-pan was being excavated. Just in front of the slab was a stout log 3 feet in length, the ends and sides charred by fire. This reached to the surface and was one of the stakes observed when the cave was entered (see upper right center, plate 6, a); whether or not it was so placed at the time the burials were made we were unable to tell. It may have been a marker, but we have found no other burials indicated in this way.

Mummy 1 (female) lay on its right side, limbs loosely flexed. Two large woven bags split down the side encased the remains, one drawn over the head, the other over the feet; the tops met at the middle of the body and were sewn together with yucca leaves (plate 7, a). As usual the corpse was wrapped in a fur-string robe. Over it were inverted two baskets, a bowl-shaped one covering the feet; the other a large carrying basket with tump-line attached covering the head and upper part of the body. The baskets and the manner in which a number of digging sticks were disposed in the grave is shown in plate 6, a. The planting stick at the front with one end resting on the edge of the cist was evidently placed to hold the basket upright. The cedar bark that appears in the upper left hand corner is from another cist. On removing the carrying basket, a small dog was found lying below it on the left side of the mummy. Under the bowl-shaped basket was a substance resembling meal. On lifting the body from the cist there was found beneath it a thick bed of fur and feathers compacted by decay into a mass that was taken out unbroken. On examination at the Museum this proved to have embedded in it bundles of feathers, skin containers and skin bags; these and their contents are described under Material Culture. On the bottom of the cist was a badly shrunk, but complete atlatl and near it, but not in contact with it, was a roughly chipped piece of quartzite which may originally have been tied to its back. At one side on the bottom was a wand with a yucca braid and twigs attached to one end. Quantities of grass seed, piñon nuts and squash seeds were also found at the bottom of the cist.



a, Cradle *in situ*, Cist 54, White Dog Cave; b, Cave 10, Sagiotsosi Canyon.

Mummy 2 (male about 35 years of age) lay on its left side with feet drawn up tight against the body; head east and facing south. It was wrapped in the same manner as mummy 1 (see plate 8). Inverted over the body was a large pannier basket which is shown behind the front basket in the photograph (plate 6, a); over the head was a bowl-shaped basket. A second basket of the same shape lay just to one side, covering the fragments of a squash shell vessel. Removing the pannier, three tray-shaped baskets graduated in size with the smallest at the bottom were found beneath. The pannier also partly covered the remains of a large long haired and nearly white dog, which in turn lay across the two bowl-shaped baskets (see plate 6, b). There was also found under the pannier a large quantity of flies, the dog having apparently been already fly blown when placed in the cist. The eggs evidently hatched and the flies died in the space under the carrying basket without ever seeing the light of day. We thought that the flies might serve to fix the time of year in which these burials were made, but Mr. N. Banks of the Museum of Comparative Zoölogy, to whom we are indebted for their identification, informs us that they are *Caliphora coloradensis*, a very hardy species which flourishes from early spring to late fall, so it is not possible to fix a very definite date by them. The digging sticks might indicate that the spring planting was in progress, but this is of course mere conjecture.

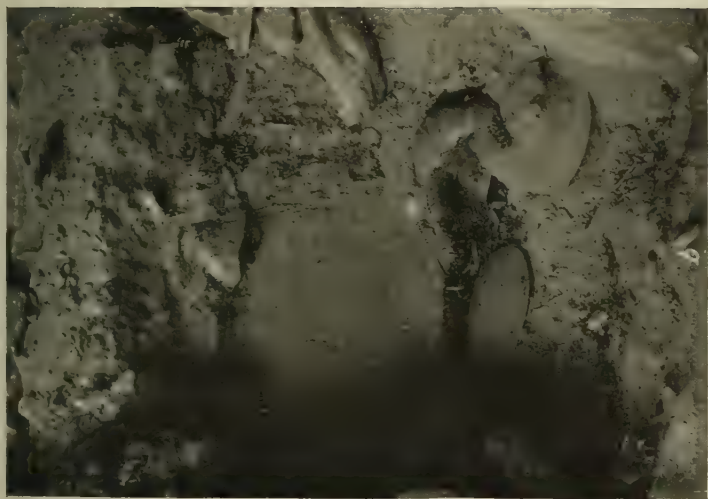
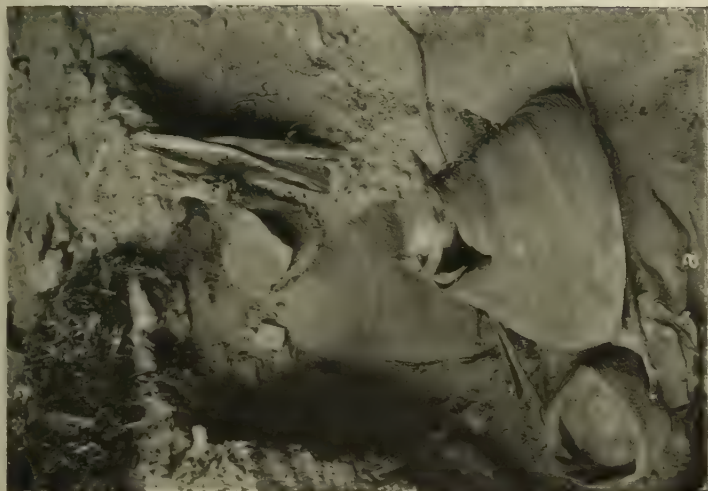
Extending from the edge of this cist on the east side was a shallow hole just deep enough and of sufficient size to contain the remains of a young infant. Only the bones, and part of a badly rotted fur-string robe were left.

Cist 27. The unusual plan of this cist is shown in figure 5. It was dug in hard-pan to a depth of 2 feet 10 inches, measured 4 feet 9 inches in length and 2 feet 6 inches at its widest point. The sand and fill above had a depth of about 1 foot. One side of the cist was formed by the face of a vertical break in the rock floor of the cave, the ledge nearly cropping through the hard-pan at this point, a circumstance which probably accounts for the elongated shape, as the rounded end seems to indicate an original intention to dig the conventional circular cist. In it were found the partly mummified bodies of two adults placed one above the other, facing in opposite directions (plate 9, a).

Number 1, the uppermost, an adult, probably male, lay face down, knees drawn up and crushed against the chest, feet under hips, left arm extended at full length along the side; the right forearm was bent across the waist. Number 2, a male of about 25 years, lay on the bottom of the cist directly under mummy 1 and with head in the opposite direction. The limbs were arranged in practically the same manner as those of the upper mummy, the feet of which rested on the face of this one.

Accompanying these remains was a large number of specimens some in a good state of preservation, though objects at the bottom of the cist and baskets at the top and sides had suffered from decay. We were, however, able to determine that there had been at least seven baskets, mostly medium sized trays. In preparing the cist to receive the bodies, a number of atlatl spear-shafts had been broken into various lengths and placed crisscross on the bottom. On the upper side a few inches out from the rock there stood on edge a rectangular frame of sunflower stalks and broken atlatl spear-shafts tied at right angles to each other. Back of it, also on edge, were placed several tray baskets. On the opposite side next to mummy 2 were bundles of sticks or reeds so badly shrunk that their nature could not be made out with certainty; they were probably atlatl spear-shafts. Placed over mummy 2 were more spear-shafts and the bundled fragments of a wooden device, part of which is figured in plate 36, d, e. At one side of mummy 1 were two grooved clubs. Quantities of grass and squash seed were found in much decayed skin containers; also a number of small objects, among them a fine chipped knife blade, beads of seed and stone, pendants of shell and stone, a comb-like head-ornament and a bone handle with leather strings attached.

Cist 30 was a jar-shaped excavation in the hard-pan, 15 inches in diameter at the top, 23 inches in diameter, 1 foot below the rim, and 24 inches in depth. In it were the skeletons of six infants. Four were found in woven bags. Of other wrappings there remained tattered pieces of dressed skin and bits of fur-string. Five umbilical pads, similar to those from *Cist 11*, Sunflower Cave, were taken from various parts of this cist. These could not be assigned to individual burials as the skeletons were more or less mixed as if the cist had been partly rifled in early times. At the bottom were two cradles in excellent condition. A few inches



WHITE DOG CAVE

a, Cist 24, partly cleared, showing baskets *in situ*; b, Pannier baskets removed, showing small baskets, mummy of white dog, and many dead flies.

above these were about 8 quarts of shelled corn; no trace of a container could be found. Scattered through the fill were beads of seed, stone, and olivella shell, a green stone pendant, a small grinding stone, and two strips of bark, like the piece found in Cist 7, Sunflower Cave. Joined to this cist by a small funnel-like hole was a second cist, the same diameter but not so deep, while cutting the rim of this was a third and larger one (Cist 33, figure 5). These were empty; they form a good example of a number of similar arrangements found in the course of the excavation (see Cist 52, figure 5). All are characterized by one or more small flue-like holes dug down from the surface and penetrating the sides of the cist, or, as in the case above noted, connecting small potholes to the cist (plate 9, d, and plate 14, a). Sometimes these holes, instead of entering the large cist obliquely, were dug at nearly right angles from the pothole to the side of the larger cist. As a rule cists of this type were empty save for bark or grass stalks. They strikingly resemble the field pit-ovens used by the Hopi for roasting corn;¹ there are no indications, however, that these had ever had fires built in them.

Cist 31 as shown in the plan, figure 5, was partly under one end of a large rock. In order to reach it we were obliged to remove from the surface many others, some so large that they had first to be broken up. The top of the cist was 3 feet 6 inches below the surface, its greatest diameter 4 feet, depth 1 foot 10 inches. At one side was a single stone slab. In the cist was the partly mummified body of an adult, the bones of the skeleton held together by dried tissue and caked adobe (plate 7, b). The remains rested on the left side, knees drawn up level with chin, hands palms together under left cheek and supporting head. A woven bag covered the head and shoulders. It had been split down the side before drawing on, then sewn together again with yucca leaves. A portion of the bag was in good condition. Over the mouth of the mummy outside the bag, was tied a sandal of the square-toed type. About the feet and lower part of the body were the remains of a fur-string blanket. The bag and wrappings were held in place by a binding of yucca leaves. About the neck were seed beads. Inverted over the middle of the body was a coarse bowl-shaped basket; under it lay a quantity of plant stalks, apparently

¹ Hough, 1919, figure 3.

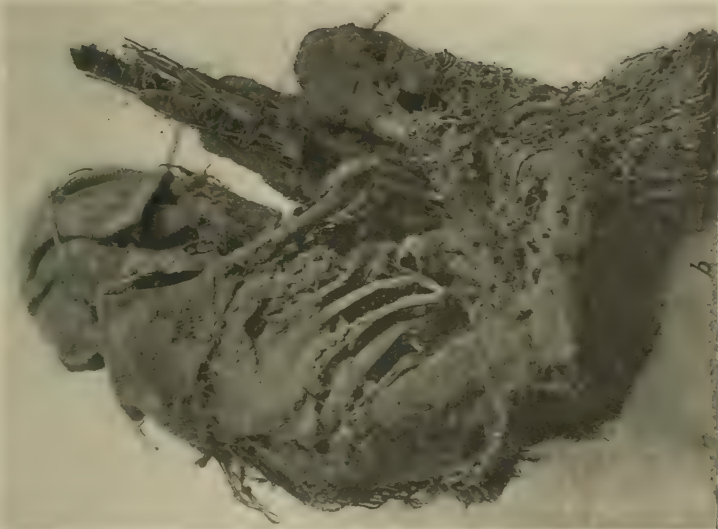
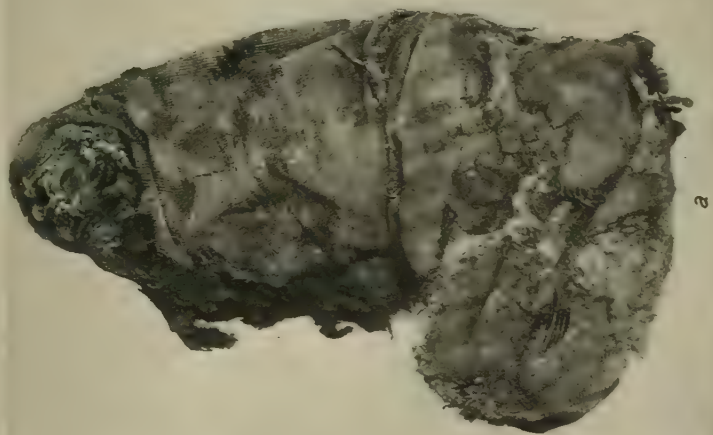
of Brigham tea, also an animal bone and a pointed twig with a string attached. In the lap, as shown in plate 7, b, was a bundle made up of two wooden implements, a foreshaft with stone point, a wand-like stick with a bunch of reddish fiber tied to the end, and a small woven object, the whole wrapped about with a feather headdress and a number of turns of fine string (plate 40). The fill about the body was caked and discolored. Nothing was found in the cist under the body.

Cist 32 gave indications of previous disturbance. It was dug in the hard-pan against the side of the cave and showed more than usual care in the smoothing of its walls. It was oval in shape, 3 feet 6 inches in length, 2 feet in width, and 2 feet 6 inches deep. In the edge of the end opposite the cave wall was a shallow groove perhaps made to seat a cover. In the upper part of the cist was the skeleton of an infant and remains of a small reed-backed cradle, both too far gone to collect. In a sub-excavation at the bottom was the skeleton of a child about six years of age, knees drawn up to chin, head north, face southeast. About the remains were traces of fur-string wrappings and coiled basketry; under them a small quantity of green powder. This cist was probably originally a storage cist and perhaps had a stone slab cover which fitted into the groove at the end. It may have contained at one time other remains than those found, for it would hardly have been dug for them alone, as it was of much greater size than necessary.

Cist 35 was not dug straight into the hard-pan, but was slightly undercut. It measured 1 foot 3 inches across at the top and 2 feet 6 inches in greatest diameter; the bottom was rounded. In it was the mummy of a baby on a reed-backed cradle; the body was enclosed in a bag and lay on a twined-woven cedar-bark mat (plate 21, d). All were in good condition. The mat appears to be part of an old cedar-bark cradle like the ones found in Caves 1 and 2 by the 1915 expedition.¹

Cist 40 was a large jar-shaped storage cist excavated in the hard-pan. It was very symmetrical in shape and measured 2 feet in diameter at the top, 4 feet in diameter 2 feet below the rim, and 4 feet 6 inches in depth (plate 9, b). The rim was 2 feet below the surface. In the top was found a rabbit net tied in a compact bundle, together with a quantity of apocynum bark done up in

¹ Kidder-Guernsey, 1915, p. 165 and plate 72.



WHITE DOG CAVE

a, Wrapped mummy of woman from Cist 24; b, Mummy of man from Cist 31.

bundles. The net had evidently been cached here after the cist was abandoned and filled up, since the hole in which it rested was partly dug in the hard-pan at the edge of the cist, and partly in the fill of the cist itself. In clearing the cist a thick layer of cedar bark was found 1 foot from the bottom; below it was clean sand. One foot from the rim on the side opposite the net there was a pot-hole, 1 foot in diameter and the same in depth.

The rabbit net, a remarkable specimen, is described in detail in another place. Its lack of definite relation to the cist or to other Basket-maker remains at first raised a doubt in the authors' minds as to whether it might not have belonged to a later period. On the other hand it will be remembered that a very similar excavation at the side of Cist 24 contained the remains of a Basket-maker infant.

Cist 41 gave evidence of previous disturbance. On clearing it a small niche was found in one side that contained the remains of an infant, a small basket, a skin covered object (umbilical pad) and the usual fur-string robe.

Cist 51, 3 feet 6 inches deep, and 2 feet 6 inches in diameter, was constructed of slabs set about the sides of a shallow excavation in the hard-pan. It contained the skeletons of an adult and an infant. The former lay on its right side, head south. The infant rested across the breast and left arm of the adult and had been wrapped in a fur-string blanket and placed in a skin bag. Both blanket and bag were in an advanced state of decay. There were traces of a woven bag that had once covered the remains of the adult. At one side of the cist near the head of the adult was a small bowl-basket containing beads and a variety of small objects, which are described elsewhere. There were also in the cist food offerings of corn and piñon nuts.

Cist 54. After removing from the surface a large number of rocks, the fill under the end of the great rock in the center of the cave was explored. Here, 2 feet below the under side of the rock in what appeared to be a rude cist, there was found a cradle in excellent condition. With it were fragments of fur-string blankets and pieces of woven bags, but no trace of a body. The photograph, plate 5, a, shows the cradle *in situ*. The thin edge of the rock had been broken off somewhat before the picture was taken; it originally extended nearly a foot further than is shown. The

rock may have broken from the roof centuries ago or in very recent times. The cradle, however, must have been in the position in which it was found when the fall occurred.

Summing up the evidence as to mortuary customs contained in the foregoing descriptions, we see that the bodies were placed in cists of three sorts: jar-shaped excavations, whose primary purpose seems to have been for storage; larger, shallower pits apparently dug expressly to contain burials; and slab cists of the type illustrated in plate 9, c. Almost every cist held more than one individual and all the indications pointed to the interments having been made simultaneously.¹

The bodies of adults were always wrapped in fur-string blankets and at the loins of most females were small string aprons. The limbs were flexed to occupy the least possible space and occasionally held in that position by cords. The bundles thus prepared were encased in large woven bags, which were cut down one side for greater ease in drawing on, and then stitched together again with yucca leaves. Babies were sometimes placed in bags, but were more commonly buried on their cradles with their blankets, umbilical pads and "diapers" of bast in place as in life.

No fixed manner of orienting the remains was adhered to, this detail having been decided, apparently, by the manner in which the body best accommodated itself to the shape and size of the cist.

Mortuary offerings were numerous and varied and seem fairly representative of the food, implements, weapons and ornaments of daily life together with some objects of a ceremonial nature. The standard gift to the dead was basketry; tray baskets were practically always inverted over the heads of adults, often over children; large panniers also served as covers; and smaller baskets, empty or filled with trinkets, were generously piled into the graves.

Kiva (?). There remains to describe a peculiar and puzzling room found at the front of the cave (see figure 5). The first intimation of its existence came when, in clearing the surface above what proved later to be the ventilator shaft, the wall of the main structure was exposed. The room, as shown in the plan, lies at the foot of the great rock pile which rises at a sharp angle to the

¹ The same thing was noted in Sunflower Cave (Cists 7 and 11); in Cave 1 Kinboko (Kidder-Guernsey, 1919, p. 83) and in the Sayodneechee burial cave (Ibid. p. 29); at the latter site there were more individuals per grave than in any of the others, one cist holding no less than 19 bodies; all, apparently, buried at one time.



WHITE DOG CAVE

Mummy of man, Cist 24: a, Wrapped; b, With coverings removed.

back of the cave. It was owing to the imminent danger of rock slides from this source that we were unable to excavate the room completely, either in 1916 or on a second visit to the cave in 1917, when another attempt was made to do so.

This chamber is, and apparently always was, entirely subterranean. The part that we were able to clear is irregularly circular. The room is sunk through the surface sand and into the hard-pan, which, standing as dug, forms the lower part of the wall (see figure 7, b). The upper wall is masonry of rough and irregular

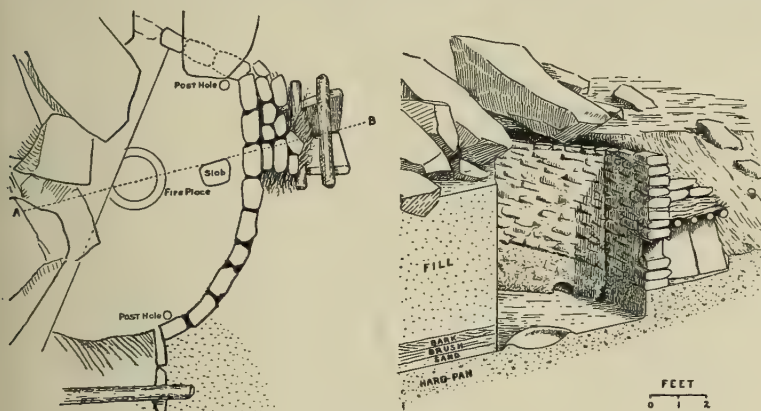


FIGURE 7

White Dog Cave: Plan and Cross-section of Kiva.

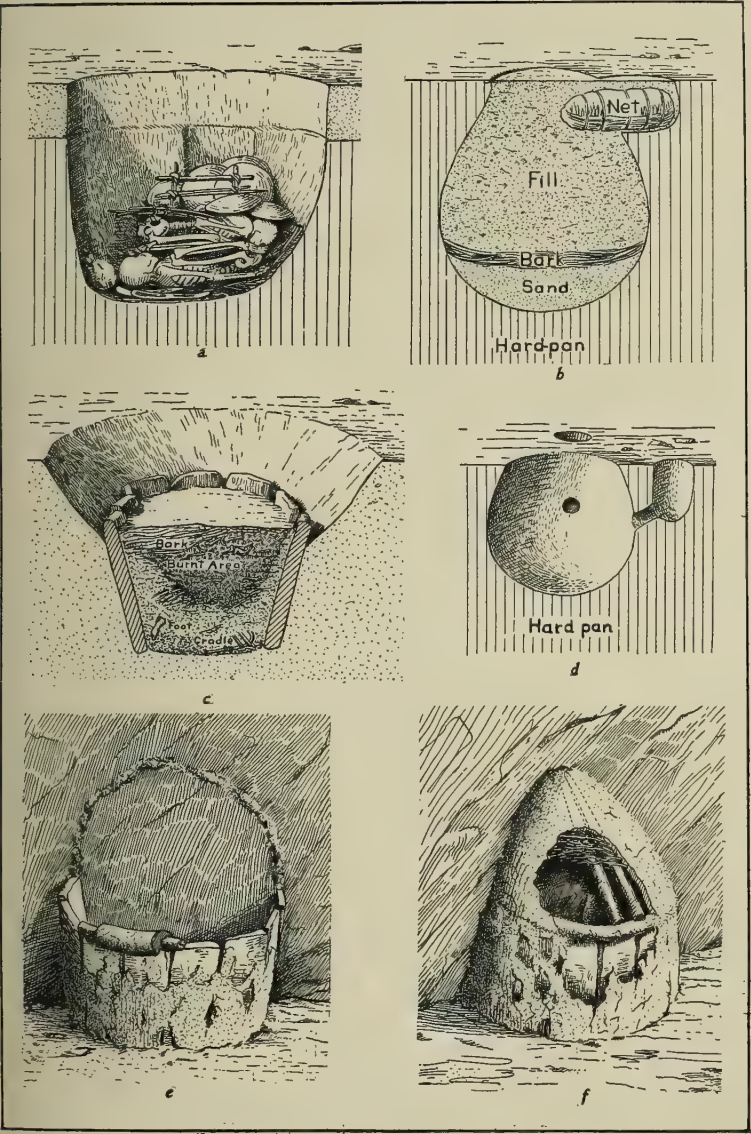
stones laid with little attempt to preserve a smooth face either within or without. At one point on the east side two upright slabs were set in and the wall was built on them. The top courses are somewhat more carefully constructed. Adobe mortar is used, sparingly below, more abundantly above. The whole structure is thickly "spalled" with small fragments of stone wedged into the cracks.

The general shape of the wall, partly straight, partly curved, can best be seen in the plan and section. The southern offset, which in the plan has the appearance of a bench or banquette, we are inclined to think was not a part of the original design of the builders, but was made necessary by the occurrence here of an outcropping of the ledge, the upper surface of which slanted inward at too

great an angle to furnish a stable foundation for a wall along the inner edge. At any rate, the offset overcame this difficulty, though for some reason, instead of continuing the wall as before, of laid-up stones, stone slabs set on end were used. We do not know whether or not this method of construction is continued under the rock pile. Placed across the top of the slabs was a stout log, one end resting on the top of the offset, the other passing out of sight under the rock heap. It is possible that the entrance to the room was at this point, as the sloping surface of the ledge here is very smooth as if from wear. South of the offset and outside the room we found slabs, set at right angles to the wall, and three upright stakes burned off close to the adobe in which they were embedded. There was a large amount of charcoal in this area. The slabs of the offset wall and those outside were much blackened by smoke.

On the east side of the room 2 feet above the floor, there is a small opening leading through the wall into a ventilating shaft. This orifice is five and one-half inches high by eight inches wide; it has two slender, round lintel sticks running across its top, their ends embedded in the masonry at either side (figure 7, b). All the edges of the opening are neatly finished off with adobe, the corners carefully rounded. On the floor of the room, nearly in front of this hole, lay a thin slab of rock measuring 11 by 12 inches; on trial it was found to fit exactly into grooves around the hole that had obviously been made for it (plate 10, b).

The horizontal shaft, to which the opening gave access, extended out from the wall for a distance of 3 feet 6 inches. It was built of flat stones set on either side with their bases together and their tops slanting outward, making a V-shaped trough 2 feet 6 inches wide across the top. This was roofed over with short stout logs covered with cedar bark, brush and coarse grass, the whole held down by flat rocks. The photograph, plate 11, b, shows the east end of the shaft with its log roofing. Behind and above may be seen the outside of the top courses of the wall of the main room, the position of which is also indicated by the dotted line in plate 11, a. There is no trace of a vertical flue connecting this horizontal passage with the surface. The pitch of the deposit is so steep here that it is probable that such a shaft was unnecessary, and that the horizontal passage ran straight through to the outer air.



Types of Basket-maker cists: a, b, d, White Dog Cave; c, Cave 6; e, f, Cave 14.

The floor of the room itself, as far as we were able to lay it bare, was of hard packed adobe with a smooth but uneven surface. At what seems to have been a little east of the middle of the room there is a firepit, a saucer-shaped depression in the floor with a neatly made coping or rim of hard baked adobe (plate 10 a). It was filled to the brim with clean white ashes. In outline the pit is a perfect circle, 2 feet in diameter; the rim is raised 3 inches above the floor, and the bottom is somewhat scooped out giving a depth of 5 inches to the center of the pit.

At the floor level in the back of the room is an oval niche dug horizontally 12 inches into the hard-pan of the wall, and measuring 18 inches across the front (see figure 7, b). There are two holes five and one-half inches in diameter and twelve inches deep, dug in the floor, one at the angle of the back and east wall, the other at the front directly opposite. So close are these holes set to the wall that at the back the sides of the holes are continued up through the adobe of the wall for some 6 inches. For this reason we are quite sure they are intended for post-holes though no post ends were found in them.

The filling of the room was entirely free from rocks, showing that the great pile that now covers its rear portions and its northeast wall must have fallen after the place had already been deserted for a long time. On the floor was a 3-inch bed of pure sand; above this was an equal amount of coarse brush and charcoal, topped by a layer of cedar bark. The remaining 4 feet 6 inches to the surface was a homogeneous deposit composed of equal parts of rat dung and sand, laid down in perfectly regular, thread-like horizontal strata, separated from each other by thin layers of clean wind-blown sand.

The peculiar make-up of this fill has been a matter of much discussion between the authors. A plausible history of the fill might be that the room, with roof still intact, was abandoned for a period sufficient to allow the three-inch layer of clean sand to sift in and accumulate on the original floor, after which it was retenanted for a short time, the brush and bark brought in, and fires built, then vacated finally by man to become the rendezvous of rats through the long period which must have been required to build up the deep deposit of rat dung and sand found in it. During this latter period the roof remained; otherwise, instead of thin regular layers of ap-

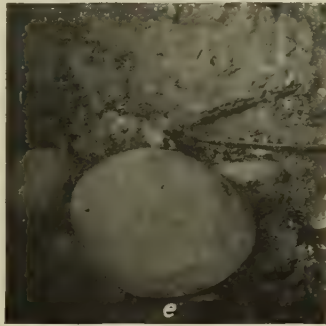
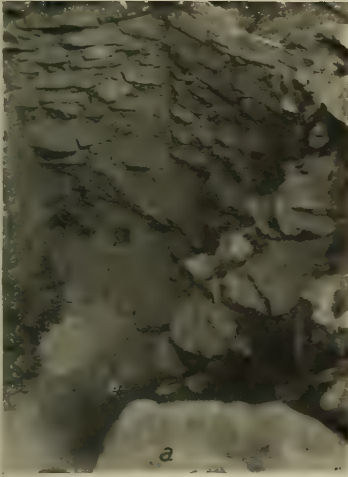
parently sifted sand, there would have been sand deposits of varying thickness, marking the occurrence of high winds such as we experienced while at work in the cave. Finally, and prior to the falling of the rocks from the ceiling of the cave, there came other visitors who found the roof a convenient source of fuel supply thus accounting for its complete disappearance.

Such a long discussion on the foregoing may appear unnecessary, but any condition which marks the lapse of time seems worthy of careful consideration.

It is unfortunate that we were unable to clear this room completely as there may be concealed beneath the *débris* which still covers the unexplored portion some evidence that would settle definitely the question of whether it is the work of the people who excavated the cists and buried their dead here, or of the Cliff-dwellers who came after. Such artifacts as were found in it are of little assistance in identifying the builders since they are either devoid of character or of such a nature as might easily have been dragged into it by rats. Outside the wall on the northeast and east sides we found some evidence of disturbance, such as might have been made in excavating for the foundation of the room, and in this disturbed area, close against the wall, lay two sandals with side-loops, of a type quite common in cliff-dwellings but which we have not yet found directly associated with Basket-maker remains. One of these was touching the wall at a depth of about 3 feet below the surface.

Had the chamber just described been found in a pueblo or cliff-dwelling, it would have occasioned no particular surprise, for while its ventilator opening is smaller and higher set than usual and the V-shaped horizontal passage is of unfamiliar construction, yet the mere presence of a ventilating apparatus, the adobe rimmed fireplace full of white ashes, and the subterranean situation of the room itself are all features perfectly normal in Cliff-dweller kivas. Furthermore the kivas of this particular district are typically variable and unspecialized.¹ The sandals seem to be Cliff-dweller and to have been left where found while the wall was under construction. All these things point to an origin subsequent to that of the Basket-maker cists. On the other hand we have never seen, nor have we read of, a kiva built as is this room all by itself

¹ Kidder-Guernsey, 1919, p. 201.



White Dog Cave: a, Interior of kiva; b, Ventilator cover in kiva; d, Baskets in Cist 22; e, Objects in Cist 13. Sunflower Cave: c, Skeletons in Cist 7.

with no living-chambers in the vicinity. All kivas with which we are familiar form integral parts of house-clusters. The only surely identifiable Cliff-dweller remains found in the cave are enumerated as follows:

A storage room foundation was built on the sloping rock floor against the west side of the cave (see figure 5); it measured 5 feet in length, 2 in width and consisted of a low wall, 8 to 10 inches high, the stones mudded in with adobe mortar. In the enclosure was a bed of plant stalks, "Brigham tea"; the floor is bare uneven rock. We collected in the top sand of the cave a few handfuls of Cliff-dweller potsherds, for the most part plain gray and black-and-white ware, and a few pieces of feather string. A small corrugated pot covered by a flat stone was found cached in the sand 1 foot 6 inches below the surface; the mouth had been sealed with adobe mudded on to corn cobs, but this had crumbled and was found at the bottom of the jar. About the jar was a harness, made, with the exception of one short section, of Cliff-dweller feather string. The short piece is apparently Basket-maker fur-string and was probably a stray bit picked up from the surface.

The above is not an imposing list and leads us to doubt that the place was ever regularly used as a dwelling by the Cliff-house people. As to the identity of the kiva-like room, the writers themselves are not agreed; the senior author believes that it may possibly be of Basket-maker origin, the junior considers it surely Cliff-dweller, but can offer no explanation for its isolated situation.

FIELD WORK, SEASON OF 1917

REACHING Kayenta by the usual route via Farmington, New Mexico, and the Chinlee, the party first attempted explorations near Sayodneedchee Canyon in Monument Valley, but was forced by lack of water to abandon the work after a few caves had been examined. Returning to Kayenta the exploration of the South Comb was resumed. White Dog Cave was revisited and an unsuccessful attempt was made to move the rocks from above the kiva-like room. Two new caves were discovered and investigated. Again forced to move by lack of water, the remainder of the season was spent in Sagiotsosi Canyon, where nine caves were either wholly or partly explored (see map, figure 1).

SAYODNEECHEE CANYON

This is one of the numerous short canyons which head near the Agathla rock and run northward into Monument Valley. Although it is without living water, the Navajo are able to cultivate corn in certain places. In the winter, rain and melting snow furnish sufficient drinking water for the Indians and their flocks; and in some years enough of this is held in pockets among the rocks to last until the showers of July and August. Generally, however, these natural reservoirs go dry in June and the Navajo must move away for a month or so to some more favored locality, returning after the rains to harvest their crops.

Aside from its dryness, Sayodneedchee is a most attractive place; the scenery is magnificent, grass and firewood are abundant, and the cliffs contain many caves to tempt the archaeologist's shovel.

Caves 3, 4 and 5 are in a break of the rock ridge that forms the west wall of Sayodneedchee Canyon, and are nearly opposite the Basket-maker burial cave in the above canyon excavated by the 1914 expedition.¹

Cave 3 is a mere shelter measuring 15 feet in depth by 30 feet in width. The wash of a small canyon has cut away the floor at the front. On the back wall are a number of pictographs done in white, red, and yellow paint; some of these are reproduced in plate 13, a. We found several slab cists buried beneath the sand floor. They contained nothing except cedar bark.

¹ Kidder-Guernsey, 1919, p. 27 and figure 1.



WHITE DOG CAVE

a, Rock pile in center of cave; b, Southern wall and ventilator in kiva.

Cave 4, a short distance up the canyon, is 20 feet above the wash. It has a depth of 12 feet and measures about 24 feet across the front. The floor is of hard-pan free from surface sand. In it are a number of small cists or pot-holes. At the front the hard-pan formation has a vertical break, in which is dug a small cubby hole measuring 4 feet in depth by 3 feet 6 inches in width. At the entrance to this little room, shown at the left in plate 12, a, are a number of flat slabs arranged like steps, a single slab 2 feet long and 8 inches wide serving for a sill. There are several small holes dug through the top of the room to the surface above. The largest of these holes is plugged with a rock.

A little further along the cliff is a rectangular Cliff-dweller room, the dimensions of which are, length 12 feet, width 7 feet, height of wall 6 feet 6 inches. In the center of the front wall is a doorway 29 inches high, 16 inches wide. At the top is a flat stone slab lintel supported by two round sticks built into the wall, another slab serves as a sill. The edges have grooves or jambs for the reception of a slab door. The masonry of this room is good. There were no pictographs. Potsherds were plentiful and along the cliff near the room there was some rubbish and a number of ash beds.

Cave 5 is still further up the canyon. It measures 45 feet across the front, and 15 feet in depth. At the back are the foundations of a room 10 feet long by 6 feet wide built out from the cliff. The masonry is of stones laid flat in adobe mortar. Two slab cists and two cists dug in the hard-pan floor were found in the cave, but no specimens.

Near the sites just described is a small shelter on the ground level of such insignificant size that no number was assigned to it in our field notes. We dug here, however, and at a depth of one foot below the surface found two slab cists partly filled with cedar bark. These were undoubtedly storage cists, as near by is a Navajo cornfield, located in a small basin which collects and retains such water as in time of rain runs off the surrounding cliffs, an advantage probably recognized by the early occupants of the region as readily as by the present day farmers.

The principal structures in these caves are of course Cliff-dweller. The slab cists and possibly some of those excavated in the hard-pan we are inclined to think are Basket-maker. No great amount of work was done at any of the sites, as we were on such

short rations of water that our examination really only amounted to a reconnoissance. Continued drought finally drove us away, and we returned to the South Comb.

SOUTH COMB REVISITED

Cave 6. This site is in the next break in the Comb north of White Dog Cave, a distance of about one mile in an air line. It consists of a small alcove at the back of a huge crescent-shaped bay or cove in the cliff wall. Filling the open end of the crescent and hiding the cave from view in front is a high sand hill covered by a growth of thick brush and tall pines. The cliff on either side of the cave overhangs, sheltering a wide strip along the wall some fifteen feet lower than the floor level of the cave proper. On this level to the left of the entrance there is part of a roughly laid wall, built against the cliff. It forms a small enclosure and is probably the work of Navajo herders or possibly Ute, as on the smooth cave wall back of it are a number of drawings in charcoal (plate 13, f), one of which, a female figure, is shown wearing a dress that has characteristic features of the Ute woman's dress. Inside this enclosure were traces of recent fires and on the surface was a small muddled-up fire pit, which gave us the impression of having been the work of children.

The walls and ceiling of the inner cave are much blackened by smoke. It had been used as a sheep shelter and the old floor was covered by a thick layer of dung. The most careful search of the surface on the first level and the bank leading up to the cave proper failed to produce a single Cliff-dweller artifact and our excavations later showed not a vestige of Cliff-dweller occupation. Here for the first time we had a cave containing only Basket-maker remains, and while but a few specimens were found they were for the most part very true to type, the exceptions being entirely new material. A single burial was encountered. This was in a stone slab cist (plate 9, c), exactly like those found in such numbers in Cave 1, Kinboko (1915). Unfortunately, however, it had not only been plundered at some early date, but what remained of its contents had been partly destroyed by fire. The top of the cist was 18 inches below the surface. It measured 3 feet 4 inches in diameter at the top, 2 feet 6 inches in diameter at the



a, Structures in Cave 4 Sayodnecchee Canyon; b, Cists in Cave 14, Sagiotsosi Canyon.

bottom, and was 2 feet, 4 inches deep. Ten slabs were used in its construction. In the upper part was a quantity of cedar bark and a few bones from the skeleton of a child, then a mass of charcoal and charred wood in which were fragments of human bones. On the bottom at one side was a partly burned cradle frame, and the mummified foot of an adult. Other objects found scattered in the fill are as follows: fragments of fur-string robe, dressed skin robe, twined-woven grass mat, string apron, a sandal, an atlatl, a grooved club, a skin-covered umbilical pad, the bark core of another, a skin bag, a bunch of human hair, a fragment of squash shell, and many small bits that could not be identified. All these specimens were more or less charred.

But one other slab cist was encountered. Its only unusual feature was a bottom lining of thin slabs of spruce bark.

Nearly all the level portion of the cave floor was occupied by a deep ash bed in which only a few minor specimens were found. Just outside this area at a depth of 1 foot 6 inches was a tray basket, and buried in the loose fill near it at about the same depth was the small woven bag in which was the little skin pouch shown with its contents in plate 44.

On the right of the cave the floor rises and narrows until it gives place to a mere bank of débris piled up against the back wall. At the highest point of this bank and next to the wall, three deer or possibly mountain-sheep snares were found. They had been cached in a shallow hole scooped out of the fill, and were covered with cedar bark and a thin layer of dirt. These snares are new items in our Basket-maker list. They are described and figured in another place (plate 32). A few feet from where the tray basket was found, and at the same depth, were three sherds of a substance resembling pottery of unbaked clay, tempered with shredded cedar bark, and bearing on one side the imprint of coiled basketry (plate 25, a). This may really be a primitive form of pottery or may represent only some left-over material for smearing joints in a slab cist, which was prepared outside the cave where both water and clay could be had, and then brought into the cave, while soft, in a convenient tray basket, from which it was not removed until it had hardened by drying. It is the nearest approach to pottery we have yet encountered under circumstances that would free it from suspicion of Cliff-dweller origin. Mr. John Wetherill,

to whom it was shown, said it recalled the pottery found in the Basket-maker caves of Grand Gulch. This, according to McLloyd and Graham's description as quoted by Pepper,¹ was "a very

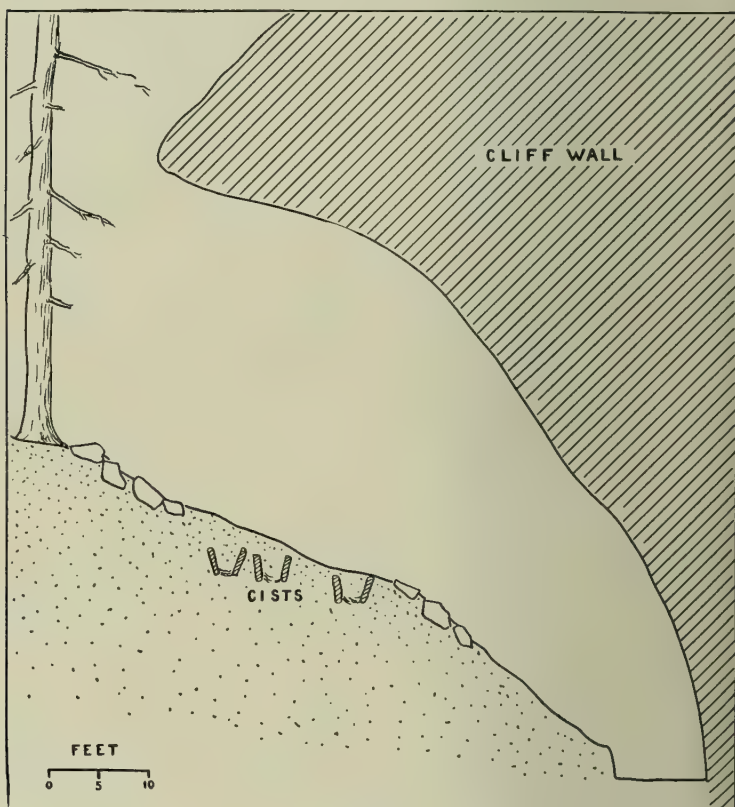


FIGURE 8
Cross-section of Cave 7, South Comb.

crude, unglazed ware, some of the bowls showing the imprint of the baskets in which they were formed."

As stated before, all our work in this cave brought to light not one trace of Cliff-dweller occupation, which includes not only potsherds, but also turkey droppings and turkey feathers, beans

¹ 1902, p. 9.

and rubbish layers. Hence the collection obtained here, though not extensive, is important as it supplies unmixed material with which to check our previous identifications.

Cave 7. About one mile north of Cave 6, we found another shelter very similar to it, except that it lacked the alcove room at the back. A steep hill rises directly in front of it. The slope of the hill next to the cliff lies almost wholly inside the line of shelter and its base at that point is cut away by an arroyo which continues along the wall for some distance. This seemed a very unpromising site, but on investigation we found a number of slab storage cists filled with cedar bark or grass, located as shown in the cross-section, figure 8. No Cliff-dweller remains were found here and only two Basket-maker specimens. These were the digging sticks shown in plate 37, e, f. This shelter seemed never to have been used as a place of abode for any great period as we found no extensive ash bed. Perhaps it was conveniently near some cornfield and was used only for storage purposes or as a temporary dwelling place while farming was in progress.

By the time that the work in Cave 7 was completed, the water in this section had become so bad that we were again forced to move.

SAGIOTSOSI CANYON

Sagiotsosi Canyon, though small in size compared with many others in this region, exceeds all that the writers have visited in the number of caves to be found in it and its branches. Its scenery is exceedingly picturesque, and it is rendered doubly attractive in this parched land by a stream of clear cold water fed by numerous springs that emerge from the base of the cliffs on either side at the upper end. This stream flows the entire length of the canyon finally to disappear in the thirsty sands just outside the entrance. In one place where it has cut a deep arroyo, a dark peat-like stratum can be seen in the vertical sides of the cut, marking an old lake bottom that probably once provided a natural reservoir for the ancient inhabitants. Today a number of well-irrigated Navajo cornfields and thrifty peach orchards show the water supply to be still ample for the requirements of primitive farming.

The caves in the main canyon are for the most part high up under the rim-rock and are perhaps more properly described as shelters. Some are of huge size with high arched openings, but of

no great depth. Occasionally they occur in groups of three or four, quite close together. To enter them one must first climb over huge fallen rocks to the first bench of the cliff, then up a steep talus of finer detritus to the caves, the bottoms or floors of which are really nothing but the truncated apex of the talus. Several of these caves have in them small Cliff-dweller structures. A number have already been explored by Professor Cummings.¹

On the right about half way up the canyon and high in the cliff is a fair sized cliff-dwelling which to date has not been excavated. An interesting feature of this ruin is a tower that commands every approach to the cave. A cursory examination indicated that the roof had been destroyed by fire. On the back wall of the cave is a pictograph similar to the one illustrated in plate 13, e.

Cave 8. This cave is in the first branch-canyon leading out of Sagiotsosi to the west. It is in reality a shelter under the overhang of the cliff, 30 feet in width, some 70 feet in length and about 25 feet above the bed of the wash. There is in it ample evidence of Cliff-dweller occupation, consisting of some foundation walls, a good depth of rubbish, with many potsherds, and a number of Cliff-dweller pictographs (plate 13, d, e); there is also a square-shouldered human figure done in white and yellow paint. This shows very faintly and a small Cliff-dweller painting of a snake overlaps it in one place (d). It was this square-shouldered pictograph that induced us to dig here, as our previous experience had shown these figures to be of Basket-maker origin.

Our excavations disclosed considerable Cliff-dweller rubbish with hard-pan below it in which we found a number of cists, empty except for cedar bark or coarse grass. These cists and the square-shouldered figure are the only remaining evidences of Basket-maker occupation. From the general digging we obtained a number of Cliff-dweller specimens including the skeleton of a young child on a perfectly preserved cradle which had been buried under the rocks at the top of the bank at the front.

This shelter seems insignificant in comparison to the huge caves in the main canyon. It provides, however, a further illustration of the fact that no cave or shelter in this region is so small that it has not at some time attracted tenants who have left traces of their occupancy.

¹ 1910, pp. 9-18.

Cave 9. Across the canyon from Cave 8 is a small Cliff-dweller ruin in a low cave that shows signs of previous investigation. Rooms along the back wall have been reroofed by the Navajo and used for storage purposes. This cave in the writers' opinion gives evidence of two occupations. This belief is, however, based wholly on the presence of typical Basket-maker cists excavated in the hard-pan floor (plate 14, c, d), for we found here no objects that could be classed as Basket-maker. The cists occurred in a small unoccupied area in the center and were completely filled with Cliff-dweller rubbish. There is, nevertheless, evidence at one place

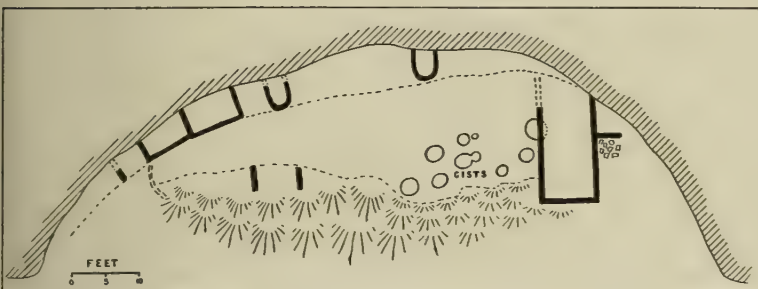


FIGURE 9

Plan of Cave 9, Sagiotosi Canyon.

that the cists were here when the Cliff-dweller structures were erected, for the side wall of one room is built partly across a cist (see figure 9). The latter could hardly have been made by the Cliff-dwellers, since they could have easily avoided weakening the foundation of their wall by digging the cist a little to one side.

In objection to the foregoing it may be said that the cists are of Cliff-dweller origin; they are, however, exactly like ones found in other caves containing Basket-maker burials, and since all Basket-maker cists have a certain unity of design and a certain "look," hard to describe but at once apparent to anyone who has opened a number of them, the authors are satisfied that their identification of the present examples is correct. Compare c and d, plate 14 with a and b of the same plate; the latter are from photographs of Basket-maker cists in White Dog Cave.

Cave 10. Just below Cave 8 there is a narrow break in the canyon wall with a length of perhaps 400 feet. About half way up this

gulch is a shelter 20 feet in depth and 40 feet across the front (plate 5, b). The only sign of occupation noticed on entering was the top of a stone slab cist which just showed above the surface sand and a number of hand-prints in red on the back wall at one side. Excavation proved, however, that the place had been occupied by both the Basket-makers and the Cliff-dwellers. The Cliff-dweller remains consisted of a few potsherds, several bone scrapers of a typical Cliff-dweller form,¹ and a quantity of corn-cobs which we think are Cliff-dweller because they are much longer and larger than the Basket-maker corn-cobs we have found.

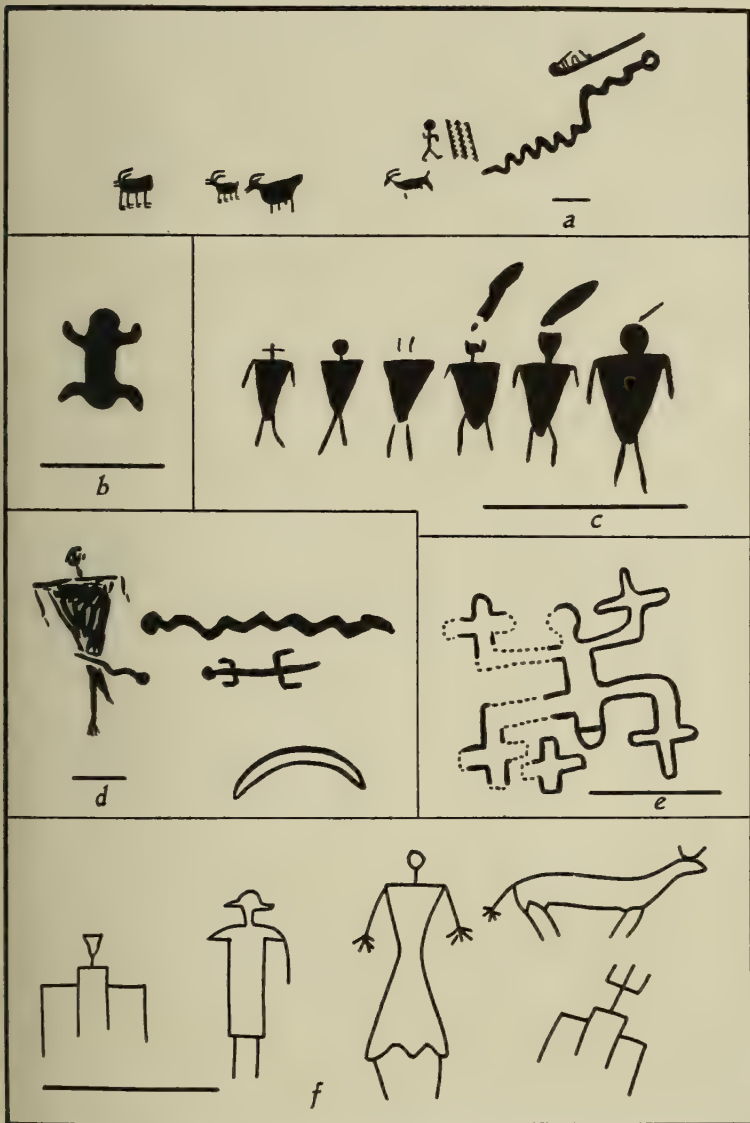
The Basket-maker remains were empty storage cists, both slab and excavated, with cedar bark in their bottoms. There was also one Basket-maker burial cist containing the partly mummified and headless body of a child, wrapped in a fur-string robe. With the body was part of a large dressed skin bag and at the feet lay badly rotted square-toed sandals. This burial was identical with those found in other Basket-maker caves. Evidence appeared that this or other cists had been plundered, as in the general digging there were found a number of fragments of Basket-maker basketry and a small piece of rabbit net made of human hair and fiber-string combined.

To gain entrance to the gully in which this cave is located one must cross a smooth, waterworn ledge. Up this is pecked a series of tracks representing the hoof-marks of a horse. They are very neatly executed and are the first instance that has come to our notice of pecked pictographs of recent (Navajo or Paiute) origin.

Cave 11. This cave is in the east wall of the main canyon near its head. It is some 200 feet above the wash and consists of a narrow shelter with a frontage of about 150 feet. On the back wall are a number of hand-prints and some nearly obliterated human figures all in white. On the surface were scattered a few bleached human bones. Large flat rocks along the front show deep axe-grinding grooves.

We were only able to spend a half day here. Our limited digging showed that for a considerable period the cave had been used by Cliff-dwellers and we recovered a number of their characteristic

¹ See Morris, 1919, figure 23, e. We found none of this variety in our cliff-house excavations in 1914.



Sayodnecchee Canyon: a, Pictographs in white paint, Cave 3. Sagiotsosi Canyon: b, Pictograph in red paint, Cave 12; c, Pictographs in white paint, Cave 14; d, e, In white paint, Cave 8; f, In charcoal, Cave 6.

artifacts from the rubbish. At one point we found a loom-anchor in place. This consisted of a smooth pole one and one-half inches in diameter and six feet long, having loops of braided yucca and heavy fiber cord strung on it at regular intervals. It was buried several inches below the floor and held down by flat rocks, the tops of the loops just protruding above the surface. Under some large rocks at the front of the cave, we uncovered a small Basket-maker pannier basket in a poor state of preservation, inverted over a quantity of corncobs; probably the corn had been stripped by rodents. Attached to it was part of a carrying-strap of human hair string.

In a narrow part of the shelter and under what must have been the path ordinarily used in entering it, we found a disturbed Basket-maker burial. Some of the bones including the skull were missing. There were with the remains fragments of a coiled basket, square-toed sandals and a piece of finely woven cloth.

Cave 12. This is a deep cavern a short distance down the canyon from Cave 11 and on the same side. It is about 90 feet above the wash and has a fairly level floor area 40 feet deep by 70 feet across the front. The walls and ceiling are much blackened by smoke, and the floor is thick with charcoal. At one point the top of a rude enclosure of stone slabs shows just above the surface. This is circular in shape and has a diameter of 12 feet. At one place in the back wall are a group of hand-prints in red placed as near together as possible and covering a space of 6 feet or more; the only other pictograph noticed is the small figure shown in plate 13, b, also done in red. On a flat rock at the front are a number of axe-grinding grooves.

Our digging here was confined to test holes, as it was obvious that it would be too much of an undertaking for our small party to clear the cave completely. We found rubbish along the back wall to a depth of a little more than one foot. It was very compact and contained a large amount of broken sticks and twigs, straw and charcoal. There were two or three slab cists partly filled with cedar bark but holding no specimens.

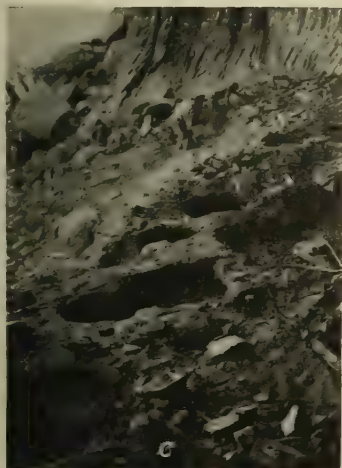
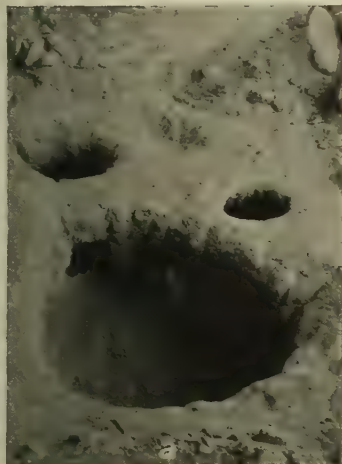
We do not think any great returns would reward further work at this site. It had apparently been used by Basket-makers and Cliff-dwellers in turn, but did not appeal to the latter strongly

enough to warrant the erection of any structures. It is set very deep in the cliff and gets but little sun; it may have been considered undesirable on this account.

Cave 13. This is a very long shallow shelter high up in the cliff near the head of the branch canyon in which Caves 8, 9 and 10 are located. At some not very remote time a great quantity of the roof had scaled off, burying almost the entire floor beneath tons and tons of rock. At one end of the cave is a series of small cliff-house rooms, some of which still retain roofs; others are crushed and the walls partly buried beneath the fallen rocks. Along the whole front of the cave can be traced a low roughly built wall. It seems probable that beneath the rocks are structures similar to those in the end of the cave, but to reach them would be a very large undertaking. We noticed no pictographs here.

Cave 14. This cave, the last to be explored, is but a short distance from Cave 13. It consists of a shallow shelter 200 feet above the canyon bottom, and has a usable floor space 20 feet deep by 70 feet in length. The line of shelter extends some 20 feet beyond the point where the floor breaks away at the front. At one end is a small niche in the back wall 7 or 8 feet above the floor. Leading up to it are a number of pecked toe-holes. The ceiling and some parts of the walls of the cave are blackened by smoke. On a smooth area of the wall near the center is a group of square-shouldered human figures painted in white, while other similar figures show faintly at other points (plate 13, c). These are distinctly Basket-maker. Built against the back wall of the cave is a series of seven stone slab structures, six of which are in a fair state of preservation. These will be given a more detailed description further on.

In our excavations here we found below the surface several slab cists of the usual Basket-maker type. From one we obtained a small skin pouch, which with its contents is shown in plate 38, a-c; also, in the loose fill, a wooden implement plate 36, a; and the bundle of human hair wrapped with string illustrated in plate 32, e. At the extreme right of the cave a single square-toed sandal was found in the general digging, and several ears of corn cached in the loose dirt against a large flat rock. So near is this cave to Cave 13 that it is inconceivable that it had not been frequented by Cliff-dwellers to some extent, yet careful search of the surface, and



a, b, Cists dug in hard-pan, White Dog Cave; c, d, Cists, Cave 9.

watchfulness throughout the digging failed to produce a trace of their handiwork with the possible exception of the corn which may be Cliff-dweller, as it is unlike the characteristic Basket-maker corn. It was found in a part of the cave quite remote from the cists. There were no potsherds, twilled sandals, feather cloth or even axe-grinding grooves. The latter are seldom absent from caves in which the Cliff-dwellers have lived.

The most interesting things in the cave are the slab structures along the back wall (plate 12, b). They average about 5 feet in diameter, the best preserved standing three and one-half feet above the surface. Large stone slabs are used in their construction, in most cases overlapping. The space between the joints is filled with adobe mortar which in some instances has been plastered all over the slabs both outside and in. Small stones are set in to fill holes between the slabs and the cave wall to reinforce the slabs at their bases. In the structures and on the surface about them were a number of timbers from 4 feet 6 inches to 6 feet in length and 4 to 6 inches in diameter, probably roof timbers. Other shorter sticks were found which had once formed a part of a rim molded on to the top of the slabs. These pieces had traces of adobe on one side; there were also found large lumps of adobe tempered with cedar bark with one side moulded round, the other bearing imprints obviously made by the short timbers just mentioned. These sections of stick and adobe are important because they show that the present above-ground cists are identical in rim construction with a subterranean Basket-maker storage place (Cist 14) found in Cave 2, Kinboko during the 1915 season.¹ Another larger cist (12) in the same cave had a similar rounded adobe coping strengthened with stones instead of sticks. The drawing, plate 9, e, represents one of the Cave 14 cists with a short section of the rim restored. The slabs are shown partly denuded of the adobe plaster, while on the wall behind the cist a line of adobe is indicated which probably marks the outline of the roof. This structure more fully restored appears in f, of the same plate.

Why so much care should have been taken to finish the rim, if the roof timbers were to rest directly on it, we are unable to say, though it is evident that a rim made in this way would greatly

¹ Kidder-Guernsey, 1919, p. 88.

strengthen the whole structure. These slab cists seem hardly large enough for living rooms or even for sleeping places. It seems more probable that they were storage cists. We do not hesitate to identify them as Basket-maker, because they are exactly like the Basket-maker structures in Cave 2, Kinboko.

MATERIAL CULTURE¹

FOOD

Vegetal Food. Maize. In 1914 and 1915 we found indications that the Basket-makers cultivated but a single and rather primitive type of corn, while that grown by the Cliff-dwellers seemed to have been more highly developed and more varied in character. Our evidence was not, however, absolutely conclusive, for certain specimens of the advanced corn were taken from Basket-maker caves, though from so near the surface that we regarded them as probably intrusive. The expeditions of 1916 and 1917 supply us, fortunately, with enough new finds to settle the question beyond any reasonable doubt. A number of Basket-maker caves were thoroughly investigated and many samples of corn were recovered from undisturbed and surely identifiable burials and storage cists; among all this material there is not a single kernel of any of the parti-colored flour or large white flint corns that are so common in the cliff-houses.²

On specimens submitted to him for examination Mr. G. W. Collins of the United States Bureau of Plant Industry has kindly given us the following report:

The collection of maize samples from the Basket-maker caves is of unusual interest.

The specimens all appear to belong to one general type, a type we have called Tropical Flint. This type resembles the New England flint varieties in having a large part of the endosperm hard or corneous. It differs from New England flint in having a larger number of rows and smaller seeds. Tropical flint varieties are common in Central and South America but are rare among the types grown by the Indians of the United States. So far as our collections show the Papago is the only tribe with varieties uniformly of this type.

The cobs of the specimens from the Basket-maker caves are all light brown in color. The pericarp is either red or colorless. The endosperm is either light yellow or white. The aleurone or layer of cells just beneath the pericarp in all the specimens is a yellowish red. This is a color entirely unknown in the aleurone of existing varieties. If this color is not the result of some slow disintegration, it constitutes the first clearly marked distinction between prehistoric maize and present day varieties.

Most of the specimens are remarkably well-preserved. The embryos have of course disintegrated but the colors are much brighter than is usual with old specimens.

¹ Only objects believed by us to be of Basket-maker origin are included. Specimens recovered from the cliff-houses will be treated in a later paper.

² See Kidder-Guernsey, 1919, p. 154.

The specimens cannot be referred to any existing variety with which I am familiar but with the possible exception of the unusual aleurone color they present no new characters.

Here then is an undifferentiated, and judging from its distribution, a primitive form of corn grown by a people whom the purely stratigraphic evidence shows to have antedated the highly developed agriculturists of the region. This agrees very well with the other manifestations of Basket-maker culture, and particularly with its lack of true pottery, stone architecture, and cotton weaving, all of which traits are characteristic of the perfected puebloan civilizations. We have thus good evidence that the Basket-makers were the pioneer corn growers of the district.

To what degree these people depended upon maize is uncertain, but quantities of it were found in the burial cists and cached for future use as food or for seed. There were also recovered agricultural implements such as would be needed for its cultivation, and the large number of storage cists in the caves would indicate by their capacity that a considerable harvest was obtained. The sites explored by us were all within easy reach of tillable land and this is also true of the Grand Gulch Basket-maker caves.

Of the actual finds of corn the best example is the skin bag full of shelled kernels from Cist 13, White Dog Cave (plate 15); there are about four quarts, every grain in perfect preservation. This may represent a food offering deposited with the dead, or perhaps it is carefully selected seed cached unknowingly in the same cist with the burials (it was found some 8 inches above the remains shown in plate 10, e). Other interments, however, were accompanied by corn and the remains of rotted hide containers, so that it may indeed be a food offering. A selection of the more perfect ears of Basket-maker corn is shown in plate 15.

Squash. This seems to have been the only other cultivated crop of the Basket-makers.¹ We unearthed with the burials varying quantities of squash seed, *Cucurbita pepo*, and many pieces of rind, as well as the complete vessel made from a squash shell that is shown on plate 31, b.

Seeds. In a number of the burial cists in White Dog Cave, large quantities of coarse grass seed were found. We saw growing in the

¹ Though we were constantly on the watch for beans in the Basket-maker sites, none were found. This strengthens our belief that they were not grown by the Basket-makers.

vicinity, the same variety of grass from which it was obtained. Mr. W. E. Safford of the Bureau of Plant Industry identifies this as follows:

Oryzopsis hymenioides, commonly called Indian Mountain Rice, is used by several Indian tribes for food; by some only in times of scarcity, by others as a regular food staple. Mr. F. V. Coville states that the squaws of the Panamint Indians of southern California gather it by means of a wicker paddle resembling a small tennis racket with which they beat the seeds from the standing grass into wicker baskets, after which they are winnowed and sifted, and parched and ground into *pinolli*. The late Dr. Edward Palmer found this seed in use among the Paiute and Pueblo Indians, who store it for winter use.

Cummings¹ found caches of seed in Saglotsosi ("coarse bunch grass"), which may be the same. No doubt other seeds were gathered and stored for food, as we found in 1915 several quarts of *Coreocarpus* seeds in a burial cist in Cave 1. Powell in his explorations of the Colorado found a tribe which subsisted chiefly on wild fruits, nuts and native grains. In our own explorations we came upon an old Navajo squaw in the vicinity of Saglotsosi who was gathering the small seeds of a low weed. She told us that these were cooked and made into a kind of mush by mixing with goat's milk, also that they were now (1917) being used again for the first time since the "great war" (Navajo war, 1863). These are identified by Mr. Safford as *Chenopodium* *sp.*, who writes as follows regarding them:

They are perhaps the most interesting of the collection. It has been impossible to determine their specific identity. They are much larger than the seeds of *Chenopodium fremontii*, gathered for food by the Klamath Indians, and those of *Chenopodium leptophyllum* eaten by the Zuñi. In shape they bear a close resemblance to the seeds of *Chenopodium quinoa*, the well-known food staple of the Peruvian and Bolivian Plateau, but they are of smaller size and of a much darker color than the latter. These seeds have been carefully compared with those of the species growing commonly in the southwestern United States; they bear a closer resemblance to *Chenopodium petiolare* than to any other species in the herbarium, but they do not seem to be identical with the seeds of that species. They are evidently rich in starch and would undoubtedly form a nutritious article of food.

Piñon Nuts. These were also an important item of diet and were found with other food offerings in many of the graves.

¹ Cummings, 1910, p. 14.

Unidentified Food. Small quantities of plant stalks, shriveled beyond recognition, accompanied some burials. These are probably from certain edible plants that grow in the region, and which are eaten today by the Navajo.

Animal Food. The bones of mammals and birds, generally so common about the dwelling places of primitive people, were entirely lacking in the group of Basket-maker caves examined. We do not believe that this indicates a preponderatingly vegetarian diet, but rather that it proves the caves to have been used merely as temporary shelters and as burial places for the dead. That these people killed a great deal of large game is evidenced by the abundance of articles made from the hides of deer and mountain-sheep; while quantities of the pelts of badgers, rabbits, prairie-dogs, and other small animals were employed for bags, pouches, and in fur-string robes. It is probable that the flesh of all the above was eaten.

As to the birds we have less evidence. Such feathers as were found came principally from hawks and owls, species not commonly relished as food by any people; or from very small birds of bright plumage such as warblers, bluebirds, and woodpeckers. As we have never come across a single identifiable turkey feather, it is reasonably certain that the turkey was not domesticated, nor indeed does it appear to have been commonly hunted.

Although there is no evidence that the Basket-makers used the dog for food, it may be well to refer here to the finding of two remarkably well-preserved dog mummies in White Dog Cave. They represent different types, formerly of wide distribution in the warmer parts of America (plate 15). Dr. Glover M. Allen of the Museum of Comparative Zoölogy, who has made an exhaustive study of the native Indian dog, has kindly contributed the following regarding these specimens:

The larger is a long-haired animal the size of a small collie, with erect ears and long bushy tail. The hair is still in good condition and though now a light golden color, with cloudings of dark brown, it may in life have been darker. It is, apparently, a breed very similar to the long-haired Inca dog found at Ancon, Peru, in a mummified condition and described by Nebring (*Sitzb. Ges. Naturf. Freunde*, Berlin, 1887, pages 139-141). The latter specimen is also described as yellowish in color, though this may have been in part due to fading. A more detailed comparison of the two specimens is not possible without removing and cleaning the bones and so injuring the present example for exhibition purposes.



WHITE DOG CAVE

Mummies of two varieties of dogs, ears of corn, and skin bag containing shelled corn.

The other dog is a much smaller, black-and-white individual, about the size of a terrier, with short, but not close, shaggy coat, erect ears, and long full-haired tail. Its muzzle is rather short and stubby in contrast to the fine slender muzzle of other Indian dogs of about the same size. In common with many skulls of American Indian dogs, the first premolar is lacking in the adult dentition of the lower jaw. This specimen is of especial interest as establishing beyond doubt the identity of certain dog bones from Ely Cave, Virginia, described as *Pachycyon robustus*, for they agree perfectly with corresponding parts of the Arizona dog. An identical breed is represented among the mummified remains of dogs from the necropolis of Ancon, Peru, and has been figured by Nebring as *Canis ingae vertagus* in the folio report of Reiss and Steubel, plate 118, figure 1. Evidently it had a wide distribution in our south and southwest, and was known also to the Peruvians. I have called this the short nosed Indian Dog.

These and other dog remains, are true dogs, in no way derived from Coyotes or other native dog-like animals of America. Their forebears probably reached America with their human masters, but their Old World ancestors still remain to be determined.¹

DRESS AND PERSONAL ORNAMENTS

Body Clothing. We have few data on this subject; it is probable, indeed, that the Basket-makers wore very little clothing except robes of fur-string or hide,² and "gee strings" or cord aprons. It so happens that all the robes found in sufficiently good preservation to permit of measurement had been interred with babies; the largest of these (plate 16, a) is only 25 by 23 inches. About an adult mummy (A-2939) from Cist 22, White Dog Cave, however, there is wrapped what appears to be a very large blanket of fur-string; and we have fragments from deer and mountain-sheep hides which seem to have been originally of ample size for use as mantles by grown people.

Nothing resembling fitted garments of leather or cloth has so far come to light; it is possible, however, that certain woven fabrics, bits of which were recovered from the caves³ may have been used as ponchos. This guess is based on the resemblance between a zigzag decoration on one of the cloth specimens (plate 26, c) and similar patterns painted on the chests of Basket-maker human pictographs from the Monument country.⁴ It must be admitted,

¹ For a discussion of the types of prehistoric American dogs, see Allen, 1920.

² For details of the weave of these robes, see p. 65.

³ See plate 26, b, c.

⁴ Kidder-Guernsey, 1919, figures 100, 101.

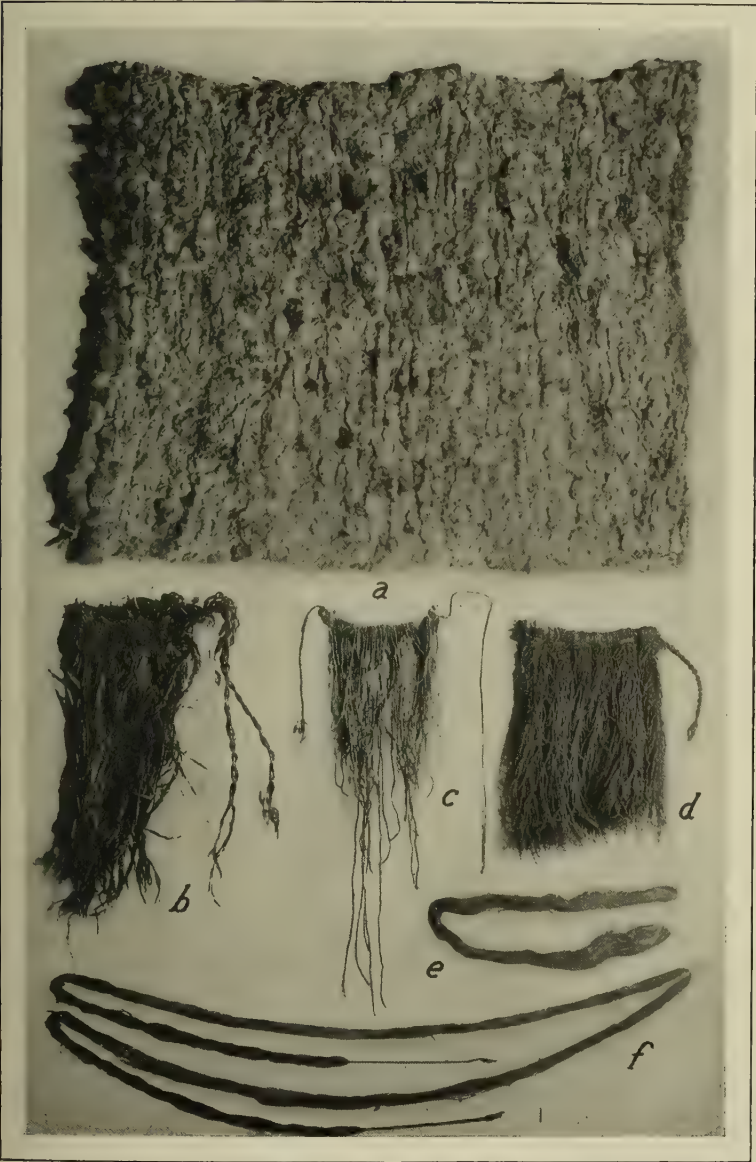
however, that the zigzag was a favorite Basket-maker design, and that the marks on the pictographs may perfectly well represent body-painting.

A string apron recovered by the 1915 expedition still remains our best specimen of this type. Although it was illustrated in our former report (plate 66, a), we have since succeeded in unraveling it for a somewhat clearer photograph; this, with a picture of a second example from the general digging in White Dog Cave, are here reproduced (plate 16, c, d). It will be seen that in both cases there is a waist cord to which is attached a fringe of pendent strings. In the 1915 specimen the strings are of apocynum and are looped over the human hair waist cord and gathered in bunches of about three hundred; the fringe is 12 inches long.¹ The apron from White Dog Cave (plate 16, c) is more fragmentary; the yucca-fiber waist cord is double; over it are hung yucca strings which are gathered together in pairs and held, close under the waist cord, by a row of twined weaving, one strand yucca, the other human hair. Although somewhat longer than the first apron this garment is much thinner and contains fewer strings.

Plate 16, b, shows part of a similar skirt made of cedar bark. The pendent strands are about 12 inches long and are held together by a twining of twisted cedar-bark string, the prolongations of which once formed the waist cord.

As the term apron implies, the fringes of these articles did not extend all the way around the body, but merely covered the front of the waist; it is probable that they hung loose, for the strings are too short to have been pulled between the legs and fastened over the waist cord behind. They are evidently a woman's garment, as in every case where they were discovered in place on a mummy, the body proved to be that of a female. Though we have never found any covering at the loins of a male, there are in the collection two objects that may well have been the ties of "gee strings." One is a loose twist of thirty animal wool threads (plate 16, f); it is nearly 7 feet long and its ends are tapered as if for knotting. The other is 5 feet 2 inches long and made of fifty to sixty thin strings of human hair; the ends are seized with fiber thread to prevent unraveling.

¹ For a fuller description, see Kidder-Guernsey, 1919, p. 157.



Clothing: a, Fur cloth blanket; b, Apron of shredded bark; c, d, Aprons of fiber string; e, f, String belts. All from White Dog Cave except d, f, which are from Kinboko Canyon, Marsh Pass. (About $\frac{1}{2}$.)

Sandals. As most of the specimens recovered by the 1916 and 1917 expeditions are very badly rotted and as no new types appear, the reader is referred to the classification and descriptions of the 1914, 1915 material given in the previous report.¹

Necklaces. These were of two sorts: strings of beads; and twisted skin or fiber cords, to the middle of which were attached a few pendants or extra handsome beads. Of the latter class there was recovered only one fragmentary example (plate 17, b); it bears two very beautifully polished lignite discs strung on a fiber cord, which is itself attached to a sinew-bound thong; the whole was probably fastened to a longer neck cord as was done with a similar specimen found in 1915.²

The second type is more fully represented, several strings of beads having been taken from the necks of skeletons in White Dog Cave. A selection is given in plate 25, e-h. The most interesting of these is composed of seventy-one thick discoidal black lignite and white limestone beads strung alternately on a narrow thong. They are graduated in size from a maximum diameter of $\frac{5}{8}$ of an inch at the center of the string, to $\frac{3}{8}$ of an inch at the ends. An unusual refinement of technic was practised by cutting several of the beads to a wedge-shape (see figure 10, c, and plate 25, h) and introducing them here and there throughout the set in order that it might hang evenly. Loose behind the neck of the mummy who wore this string were fourteen olivella shells that apparently had once been fastened together to form a sort of "dangler" attached to the tie-strings of the necklace.

Another string (plate 25, f), which was recovered in order, is made of one hundred little saucer-shaped shell beads (figure 10, g); seventy-five thin, roughly discoidal shell beads (figure 10, f); and eighteen olivella shells, one of which bears an incised zigzag decoration (figure 10, i). These different kinds of beads were grouped together. Plate 25, e, shows a third necklace composed of ninety-five beads arranged as follows: one of lignite, seven olivella shells, one of seed, one of bone, one of red shale, one of green shale, one of red shale, eighty-one of white limestone. Plain strings of olivellas designed to go once or twice around the neck are not uncommon.

¹ Kidder-Guernsey, 1919, pp. 157-160.

² Kidder-Guernsey, 1919, p. 161 and figure 72, a. A full description of this type of necklace is there given.

Beads. Under this head are considered all the beads found, whether strung into necklaces, discovered loose in the cists, or included in "medicine outfits." The commonest of all are little cylinders averaging $\frac{3}{16}$ of an inch long (figure 10, e, and plate 25, g); some are of albatite, a phase of asphaltic shale, but the great majority (hardly distinguishable from the above except under a magnifying glass) are made from some hard black seed so cut down in manufacture as to be unidentifiable. Other seeds were used un-

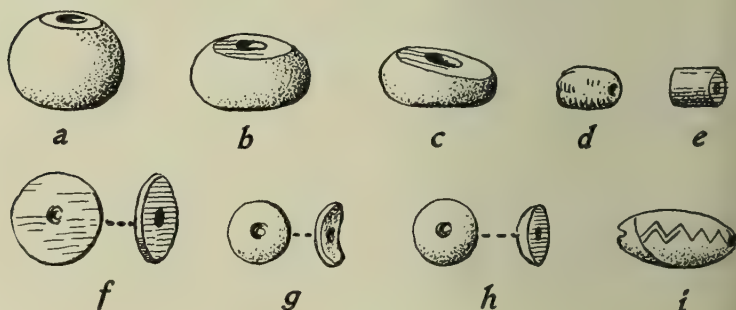


FIGURE 10
Beads from White Dog Cave. (Full size.)

worked except for a narrow bore.¹ Two varieties of these seed beads are identified by Mr. Safford:

The first is the polished white nutlet of *Onosmodium occidentale*, a plant of the Borage family, belonging to a genus not far removed from *Lithospermum*. These beautiful little nutlets may well be called pearl-seeds, since when strung they must bear a close resemblance to small seed-pearls. Accompanying these is a small longitudinally grooved dull brown seed, somewhat resembling the seeds of the bead tree (*Melia azederach*) in form. The terminal scar is removed by the perforation, and it has been impossible to identify this, or even to determine to what botanical family it belongs.

Stone beads are of fine-grained white limestone, lignite, serpentine, quartz, hematite and alabaster. Most of them are large, no minute beads, such as those from Aztec² or the Upper Gila,³ occurring. In shape they run from the flattened spherical type (figure 10, a)⁴ to the more or less thickened discoidal form (figure 10, c).

¹ See also Kidder-Guernsey, 1919, plate 70, k, a string of acorn cups.

² Morris, 1919, p. 99.

³ Hough, 1914, p. 24.

⁴ Wrongly called "hemispherical" in our former report (p. 163).

Most of the shell beads were made from olivellas simply by cutting off the end of the spire. There are in one of the strings (plate 25, f) seventy-five very thin disc-shaped beads, $\frac{7}{16}$ of an inch in diameter cut, apparently, from the shell of a fresh-water clam (figure 10, f). The same necklace contains one hundred shell beads made from the curving wall of the large olivella (figure 10, g). The saucer-like form of these allows them to fit closely over each other when strung. Enormous quantities of identical beads are in the Museum's collection from the Channel Islands, California. There are a few small bone beads (figure 10, h) apparently made in imitation of these.

Pendants. These were less common in the burial cists of White Dog Cave than they were in the mortuary cave of Sayodneechee.¹ The single stone specimen (plate 17, h) is of a hard brown stone mottled with brownish green; the surface is highly polished and has a waxy texture.

Four shell pendants were found, all of abalone; three are illustrated in plate 17, c, d, e; the fourth is attached to a ceremonial object (plate 39, b). The largest (plate 17, c) is round and 2 inches in diameter. It has two perforations in the center from which radiate the four arms of an incised cross figure. Along the edge are two other round holes and three pairs of minute perforations. At the bottom of this disc there is a drilled hole which has been stopped up by inlaying a little piece of abalone shell carefully shaped to fit the aperture. The second abalone pendant (plate 17, d) is the reused half of a disc similar to the above; it fractured, apparently, along an incised median line. Traces of the favorite Basket-maker zigzag may be seen along the upper edge of the old break. The third specimen (plate 17, e) is a bit of the thickened rim of an abalone, the edges ground down and polished.

Feathered Pendant. This object (plate 18, f) is described under the head of personal ornaments although it may have served some other, possibly ceremonial, function. It consists of nine two-ply twists of rawhide thong, seized with sinew to a loop of the same material. Small feathers, whose butts alone remain, were once fastened to the ends of the streamers.²

¹ See Kidder-Guernsey, 1919, p. 164.

² Compare Kidder-Guernsey, 1919, figure 77.

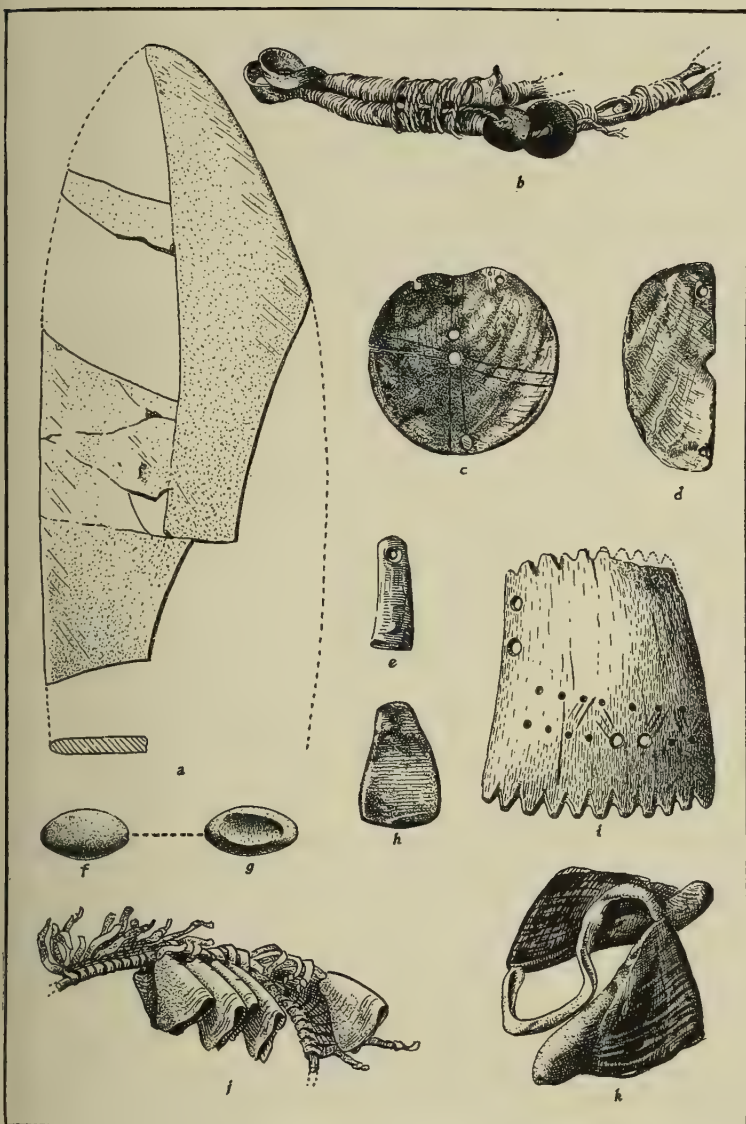
Ornament of Mountain-sheep Horn. This object (plate 17, i) is 3 inches long by $2\frac{1}{2}$ wide. The convex side shown in the drawing bears, besides two pairs of drilled perforations, a double series of small holes which do not run through. Incised lines drawn between the two series, seem to show a start at a zigzag decoration. The toothed ends of the specimen were produced by sawing broad notches along the upper and lower edges. The bottoms of the notches are well worn and smooth, but whether from general use or from friction of threads (supposing the object to have served as a weaving comb), we do not know.

Deer-hoof Rattles. As in the preceding two cases, the identification of these specimens (plate 17, j, k) as ornaments is open to question; a ceremonial use is quite as likely. One of them consists of the horny outer coverings of two large hoofs, attached to the ends of a buckskin thong.¹ The other shown in j is made of much smaller hoofs; these are fastened to the ends of thongs which themselves are looped over a slim pliable twig and held to it by a twining of fine cords. This is an incomplete specimen, as is another similar one (not figured, A-2930) which had, in place or detached, nearly a hundred hoofs. There is little doubt that the stringing together of these dry resonant hoofs was done to produce a rattling sound, but whether the assemblages were employed as belts, as fringes, or fastened to handles to form true rattles we have no means of telling.

Unfinished Ornament. This object (plate 35, h, i), found in the general digging in White Dog Cave, is a neat example of two processes in working stone: flaking and grinding. The specimen is a disc of grey flint, convex on both sides. It was first chipped roughly to its present form, then ground to efface the chipped surface. The grinding process was, however, not completed and there remain on either side marks of chipping, as well as numerous grinding facets.

Tablet. Plate 17, a, shows, partly restored, a tablet-like object of compact white limestone found in Cist 6, White Dog Cave. The pieces fitted together have a length of 7 inches, but a number of fragments that could not be joined show that the original length was considerably more; the greatest width is 3 inches, the thickness

¹ Modern Hopi hoof rattles are figured by Hough (1919, plate 22).



WHITE DOG CAVE

a, Tablet-like object of stone; b, Neck ornament; c, d, e, Shell pendants; f, g, Object of stone; h, Stone pendant; i, Object of mountain-sheep horn; j, k, Hoof rattles. (About $\frac{1}{2}$.)

uniformly $\frac{3}{16}$ of an inch. The edges are rounded and all surfaces very smoothly worked down by grinding. The fine finish and the fragile nature of this object seem to indicate that it was used as an ornament.

Head Ornaments. An object, of whose function we are not positive, but which was probably used to decorate the hair, was found on the breast of mummy 2, Cist 27 (plate 18, b). It consists of five neatly made bone pins, each $5\frac{1}{2}$ inches long and a little less than $\frac{1}{8}$ of an inch in diameter, fastened together side by side. The bindings are of sinew; the upper set is overwrapped with fine fiber cord evidently as a finish, since the string, though badly decayed, shows traces of a central red band. Projecting from the top, and held by the wrappings just described, were bundles of small feathers, of which only the butts of the quills and traces of the pile now remain.¹

Figure a, plate 18, shows a similar ornament from Cist 6, made up of three wooden pins each 10 inches long and $\frac{1}{8}$ of an inch in diameter. A bundle of six wooden pins, each 8 inches in length and $\frac{1}{8}$ of an inch thick, possibly ready to be made into a pair of ornaments like the ones just described, is figured in c. A number of finely fashioned but broken bone objects, of about the same size and shape as large knitting needles, some tied up in bundles, others loose, were found in the course of the excavations in White Dog Cave; most of them show signs of long use. These no doubt are also unassembled parts of head ornaments. There are in the 1915 collection similar broken bone pins.²

Just how these contrivances were worn we do not know, but from their comb-like structure we judge that they were probably stuck in the hair, singly or in pairs. Some basis for this belief is found in certain Basket-maker square-shouldered pictographs depicted with objects which may represent ornaments such as these protruding from their heads.³ In the Peabody Museum there is a Paiute "warrior's plume," made of five wooden pins placed side by side and held together by colored strings woven about them in such a way as to produce a simple pattern; this specimen is not feathered, but is otherwise much like those from White Dog Cave.

¹ A fairly well-preserved example from Grand Gulch is in the American Museum of Natural History, New York (cat. no. H-13375).

² Kidder-Guernsey, 1919, plate 86, e.

³ Ibid., figure 101.

In the Coahuila, Mexico, cave collection in the Museum there is an arrangement of six wooden pins which may be either a head ornament or a comb; we are inclined to think the former, as the same collection contains an object that is surely a comb, constructed in an entirely different manner.

The object shown on plate 18, d, may be an ornament, a projectile for a dart game, or possibly a ceremonial object; it is a thin twig with three small feathers seized to it at their butts and tips by sinew; the ends of the stick are broken off, so that its original length is unknown.

Hair-dressing. Several of the mummies from White Dog Cave are in so good a state of preservation that their heads still retain the hair, dressed, probably, as in life. On plate 19 are illustrated the various methods; figures a, b, c are drawn from mummies, and d, is restored from a scalp found in the same district in 1915.¹

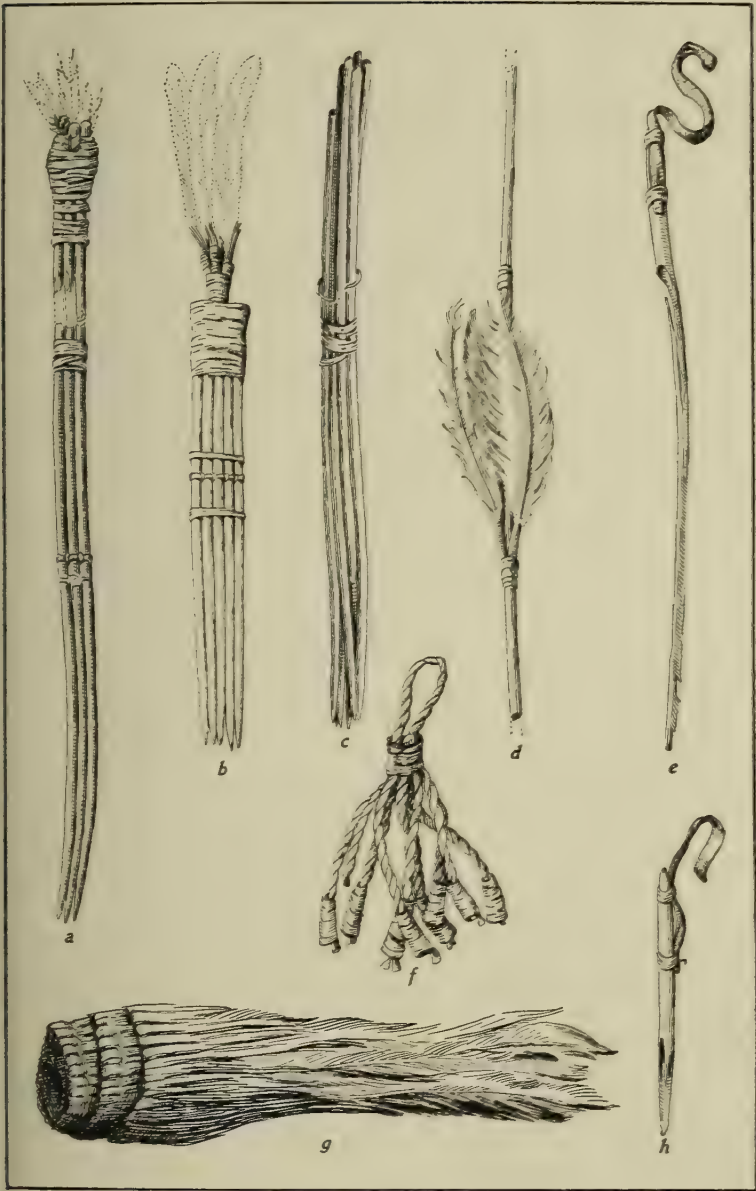
Figure a, shows the simplest manner of wearing the hair, which in this case is cropped to an average length of 2 inches. The raggedness of this haircut is apparently the result of gathering together and hacking off a single lock at a time. The individual in question was a female about twenty years of age found in Cist 22 (mummy 2).

Figure b, shows the arrangement of the hair of an adult male from Cist 24. It is parted in the center from forehead to crown and falls loose on either side; that of the back of the head is gathered into a queue, the end of which is turned back on itself and wrapped for a space of 2 inches with a fine string. From the crown there hangs a lock the thickness of a pencil closely wound with string for nearly its entire length.² The end of this tress is bound up with the end of the queue. Where this lock grows from the scalp, the surrounding hair is clipped away for a little space.

Figure c, is drawn from the head of a male about twenty-five years old, from Cist 22. The hair is arranged as follows: from a strip $1\frac{1}{2}$ inches wide straight back from the middle of the forehead the hair has been cut off close to the scalp. This exaggerated "part" terminates at the crown in a circular tonsure in the center of which there is a thin lock of long hair. The hair on either side

¹ For pictures of this interesting specimen, and for a description of its preparation, see Kidder-Guernsey, 1919, plates 87, 88, and pp. 190-192.

² As was noted on p. 13, a section of a similar lock wound spirally with a leather cord was found in Cist 6, White Dog Cave.



WHITE DOG CAVE

a, b, d-g. Feather ornaments; c. Package of wooden pins, probably used in making feather ornaments. (About $\frac{1}{2}$.)

of the "part" is gathered together and tightly bound $3\frac{1}{2}$ inches from the ends with fine human hair string; these tresses hang in front of the ears. The back hair, which is about 14 inches long, is similarly gathered together and bound near the end for a space of 2 inches. The lock from the center of the tonsure is included in this binding.

The following description of the scalp shown in d, is quoted from our previous report:¹ "A 'part' 1 inch wide, from which the hair has been clipped, runs up to a large semilunar tonsure at the crown. The brow tresses on either side are gathered together in 'bobs' that fall in front of or over the ears, and are tied up with wrappings of apocynum (?) string. The long hair from just behind the tonsure is braided into a thin plait, the lower end of which is doubled back on itself and bound with hair string. The remainder of the back hair is made into a single short thick 'bob,' string-wrapped, that falls to the nape of the neck." As shown in the drawing this specimen combines features of both figures b and c, but is more elaborate than either. It seems to have been preserved as a trophy and for this reason, when discussing it in the earlier report, we were in doubt as to whether it represented a method of hair-dressing practised by the Basket-makers, or that of some tribe of which we had no knowledge. The side-bobs inclined us to the belief that it was a Basket-maker style, as Basket-maker pictographs are often shown with "bobs" on either side of the head. The finds from White Dog Cave serve of course to confirm this idea.

Although many tribes shaved one portion or another of the head, and the thin scalp-lock was not an unusual thing, we can find no reference to analogous coiffures ancient or modern with the exception of those of the Maya thus described by Bishop Landa:

They wore their hair long, like women. On the top they burned a sort of tonsure; they let the hair grow around it, while the hair of the tonsure remained short. They bound the hair in braids about the head with the exception of one lock, which they allowed to hang down behind like a tassel.²

Judging from our material it would seem that the men dressed their hair more elaborately than did the women.

¹ Kidder-Guernsey, 1919, p. 191.

² Schellhas, 1904, p. 617.

CRADLES AND ACCESSORIES

Rigid Cradles. It seems well, before taking up the several empty cradles in the collection, to describe the one case in which we have the baby with all its wrappings still in place. The bundle is shown as found in plate 4, g, and plate 21, c; its different parts are separated and spread out in the other figures of the former plate. The infant, enveloped in robes, is tied in by means of a criss-cross lashing. The binding cord is of human hair, four-ply and 5 feet long (plate 4, i); it is rove through a series of string loops that are attached to the sides of the cradle. The seven stout cords that may be seen hanging loose on the left side of the unwrapped bundle (plate 4, g and plate 21, c), and laid out separately in h, had probably been used for hanging up or transporting the cradle; if the baby had not died so soon (it can hardly be more than a few days old), these cords would undoubtedly have been woven into a regular carrying strap like those shown in plate 23, k, l.

The outermost wrapping is a much tattered remnant of woven cloth (plate 4, a); it is described on page 63. The second cover is a fur-string baby blanket, measuring 17 by 17 inches. The body of the robe is of cords overlaid with strips of rabbit skin, its outer sides have a border, two strands in width, made of string, between the plies of which are caught bunches of long, coarse hair, probably dog. We have called coverings of this sort baby blankets because they were obviously woven to their peculiar bifurcated shape for the special purpose of leaving an opening at the place where they would otherwise constantly have been wet and soiled. Inside this blanket there was another of exactly the same size and shape; (plate 4, f) but, because it was to hold the baby itself, much softer and more carefully made. It is also of string, wound with strips of fluffy white fur from the bellies of rabbits. In handling this specimen, one is so impressed by the freshness of the fur that it is difficult to reconcile its perfect condition to its great antiquity.

The mummy of the infant (plate 4, c) lay on this inner blanket with the lower side-pieces folded over its legs. It was provided with a loose bundle of shredded cedar bark to serve as a diaper (c). On the abdomen, covering the navel, was a pad (d), made of cedar bark sewed up in prairie-dog skin, the hair side out. This obviously acted as a binder to prevent rupture. The umbilical



Styles of hair-dressing as shown by the remains from Basket-maker caves.

cord itself had been dried and was attached by a string to one corner of the outer baby blanket, so that it hung directly before the face of the infant;¹ it may be seen at the upper right-hand edge of the blanket (b).

The cradle (i) is 14 inches long and 10 inches wide. The frame is a single unpeeled withe, $\frac{1}{2}$ inch in diameter, bent into an approximate oval. The body is made of fifty straight, unpeeled twigs placed close together; these run transversely and are fastened underneath the frame by a continuous lashing of fiber string. Along each side of the cradle there extends a stout cord, fastened to the hoop at intervals and forming loose loops for the attachment of the binder that held the baby and its wrappings in place.

This cradle is much the smallest in the collection and is crudely made. It shows none of the careful finish and ornamental features of the specimens about to be described. The uncompleted carrying strap, the roughly put-together umbilical pad and the small size of the baby itself all point to the probability of birth having taken place before the usual elaborate "layette" was ready.

There are five other more or less complete cradles in the collection, all of which were found in White Dog Cave. Four had been buried with babies upon them but disturbance in some cases and decay in others rendered it impossible to recover the "mummy bundles" in their original condition; the fifth cradle was found in rude Cist 54 (plate 5, a) that contained no bones. While these specimens are all much alike in general make-up, they differ considerably in details. As no account of a rigid Basket-maker cradle has yet been published, it seems worth while to describe each one of this exceptionally well-preserved lot.

The handsomest cradle is the one illustrated, front and back, in plate 20, a, b. It is $23\frac{1}{2}$ inches long, by $14\frac{1}{2}$ inches wide at the broadest part. The rim is composed of two trimmed and peeled hardwood sticks $\frac{1}{2}$ inch in diameter, each bent into a U; the open ends of the two U-shaped pieces are spliced together with their sides overlapping a little; tight ligatures hold them in that position, and so envelop the joined ends that they cannot be seen. The

¹ As recorded by Catlin in 1842, Vol. II, p. 133. The custom of preserving the cord as a charm was practised by many tribes, particularly those of the plains. The Ute, Dakota, Arapaho, and Gros Ventre enclosed the dried cord in more or less elaborate coverings of skin ornamented with quill or bead work and fashioned usually to represent reptiles. These were hung on the front of the cradle (see Kroeber, 1908, pp. 166, 167).

body of the cradle is made of two series of slim willow twigs, from which the bark has been scraped. The transverse rods are ninety-nine in number; they are laid as close together as they will fit and are fastened at their ends to the under side of the frame by a continuous figure-eight lashing of yucca string. This binding is over-wrapped with soft fiber, until the slightly protruding ends of the rods are entirely hidden, and each side of the cradle is built up into a soft, bolster-like roll an inch in thickness; this in turn is sewed up in a cover of deer or mountain-sheep hide dressed with the hair on. The hard sides of the hoop and the sharp projecting rod ends are thus completely padded and form a sort of rim along the two edges of the cradle on its upper surface.

The second, or longitudinal, set of rods consists of five twigs running up the middle of the transverse rods and attached to them by a lashing of heavy sinew, so arranged as to produce the zigzag design seen in the photograph. The ends of the longitudinal twigs are fastened to the head and foot of the hoop in some manner which cannot be made out, because the attachment is padded and tightly sewed up in a hide covering.

Tied around the bottom of the hoop there is a horse-shoe shaped roll of cedar bark, which must have formed a kind of soft platform for the baby's feet to rest against when the cradle was held upright. A series of human hair strings are caught into the "bolsters" along the sides of the cradle; these, like the loops on the specimens first described, were to hold the laced binding cord. At the head and foot are much longer loops, designed, apparently, for suspending the cradle in a horizontal position.¹

A double yucca string is tightly stretched across the upper surface of the cradle about 8 inches above the foot. From just below this string to the foot, the cradle is much discolored by the excreta of the baby. The purpose of the string was probably to hold in place the rather inefficient diaper-bundles of cedar bark or fiber.

Plate 20, c, d, illustrates a cradle very similar in shape to the above; its measurements, $23\frac{1}{2}$ by $14\frac{1}{4}$ inches, are almost identical; the hoop is also made of two pieces tied together at the sides. The backing is of reeds instead of twigs; there are eighty-three in the transverse series and twenty-two in the longitudinal, the latter is secured to the former by narrow rawhide thongs whose emergences

¹ See Saunders, 1912, photograph facing p. 86.



WHITE DOG CAVE

a, b, Front and back of cradle, Cist 35; c, d, Front and back of cradle, Cist 54. (About 1,9.)

produce a pattern of diamond figures. The longitudinal reeds were once attached to the head and foot of the bow, but their ends are now missing. The sides are padded with fiber and covered with hide, and there are the remnants of a cedar-bark foot rest. The ends of a diaper string are present, but there are no side loops for the laced binding cord.

The remaining three specimens are more nearly oval than the two preceding. The largest one (plate 21, b) is 25 inches long by 12 inches wide. Viewed from the side it is rocker-shaped, but this curve is probably due to warping. The frame and its side-padding (mostly decayed) offer no new features, nor does the method of attachment of the seventy-nine transverse willow backing-rods. As will be seen in the plate, the longitudinal rods are differently arranged; they are in two sets of six each, spaced well apart and curving away from each other as they approach the head of the cradle where each set is bent about the side of the frame and tied back on itself; the lower attachments are gone. The diamond-pattern lashings that hold the longitudinal to the transverse rods are of strips of rawhide. Between the two longitudinal sets, and also alongside them, the transverse rods are bound together by a sort of over-eight-under-eight twilling of leather thongs painted red. Side loops and diaper string have disappeared; the mark of the latter, however, can be made out on the backing, and below it there are as usual heavy stains and caked mud.

The cradle shown in plate 21, a, is from the same cist as the foregoing. It is an elongated oval, $19\frac{1}{2}$ by $10\frac{1}{2}$ inches. Of the two sticks bent to form its frame, the upper one is peeled, the lower unpeeled. The sides are padded into the usual long rolls, but there is no evidence that they were ever encased in skin; no loops or diaper string remain. The transverse twigs are ninety-eight in number; the first seventeen, counting from the top, are in natural color; then comes a row of eight rods dyed black, then eight in natural color, eight black, eight natural, eight black, eight natural, and eight black; the last twenty-five to the bottom are undyed. The eight longitudinal twigs are not attached to the transverse ones by the usual ornamental bindings. They are turned about the frame at the head of the cradle and tied back on themselves; at the bottom they are cut off at the level of the last transverse element and their ends are made fast to it by a row of twined yucca string.

The last of the three oval cradles is $21\frac{1}{2}$ inches long, and $11\frac{1}{4}$ inches across. The two sticks of its frame are unpeeled. There are seventy-seven transverse rods (willow twigs, scraped and trimmed as usual) and seven longitudinal ones, bound to the former with the conventional diamond pattern of thong-emergences; their attachments to the top and bottom of the frame have been broken off. The frame padding along the sides is of string and yucca fiber, and was once encased in hide. There are no side-loops, but the diaper string is still in place, stretched tightly across the upper surface of the cradle at a point one-third of the distance from the head to the foot.

Flexible Cradles. These are of two types. The first has a rim made of a long thin bundle of grass rolled tight, tied with yucca leaves and bent to the same shape as the wooden hoop of the rigid cradle. The body or filling is a rough mesh of yucca leaves. The second type is a sort of mat made from long strips of cedar bark held together by twined-woven rows of yucca leaves; the edges of the mat are turned up and fastened together by a yucca network. Both types are illustrated and more fully described in the report on the 1914-1915 expeditions;¹ all the specimens recovered in 1916-1917 were very fragmentary, but enough of them were found to show that these cradles were in common use.

Umbilical Pads. During the early part of the 1916 season there were taken from the graves of infants a number of flat pads, made by sewing up various substances in covers of prairie-dog hide. Their use, at first doubtful, was made clear when the well-preserved baby burial from Cist 13 was examined, and a similar pad (plate 4, d) was found lying against the navel of the infant; a second case (infant from Cist 35) was discovered later. It was then obvious that all these specimens had been used as are our modern "binders" to prevent umbilical hernia by exerting pressure on the navel of the new-born child.

Each of these pads has a light but rigid or semi-rigid core, most commonly made of five or six corncobs cut to equal length and bound together side by side; several examples are whittled from slabs of yellow-pine bark (plate 22, c);² still others consist of a rope or tight twist of cedar bark, coiled and sewed to itself to form

¹ Kidder-Guernsey, 1919, pp. 165, 166; plates 71, b; 72, a, b.

² The piece of bark figured in our first report (Kidder-Guernsey, 1919, plate 85, b), and classed as problematical is one of these.



WHITE DOG CAVE

a, b, Cradles; c, Cradle containing mummy of child, Cist 13; d, Package containing mummy of child, Cist 35. (About 1/10.)

a small oval mat (plate 22, b); in one case a thin slab of sandstone is used.¹ The crudest were wads of cedar bark or grass. The cores were wrapped and padded with shredded cedar bark, more or less thickly according to their hardness, and were finally enclosed in prairie-dog skin covers prepared as follows (plate 22, a); the complete hide was trimmed by cutting away the feet and tail, and shaped into a long bag with the fur outside. The padded core was placed in the bottom of this, the upper part folded down, and the whole neatly sewed up with sinew or fine fiber thread. There is one specimen (plate 31, a) to which is still attached the narrow human hair string band that formerly held it in place against the abdomen of the infant.

BASKETRY

Coiled Basketry. The Basket-maker culture was so named by the Wetherill brothers because of the abundance of baskets found in the graves. The burials of this people excavated by the Peabody Museum expeditions in Marsh Pass ran true to type in this respect as in all others; and, wherever the cists were protected from moisture and undisturbed by ancient looters, fine specimens were always to be found, while throughout the general digging in the caves fragments of worn-out baskets were encountered in great abundance.

All the specimens recovered were of the coiled variety, no case of twining, checkerwork, or wickerwork having been found; a single twilled example, in reality more like a flexible pouch than a true basket, will be described later. In weave the coiled baskets form a very homogeneous group; they are made over a foundation consisting of two slim osiers laid side by side, with a padding or welt of yucca fiber or shredded roots. The sewing elements are wooden splints averaging a little less than $\frac{1}{8}$ inch wide; they enclose the rods and the fibrous padding bundle and also pass through about half of the bundle of the coil below. It is this gripping of the bundle of the lower coil which alone holds the fabric together, as the stitches of one coil never interlock with those of the coil below them.² While the weave is so solid and compact that many of the

¹ For a description of this specimen see Kidder-Guernsey, 1919, p. 192; its use was then unknown to us.

² For a diagram of the weave, see Kidder-Guernsey, 1919, figure 80.

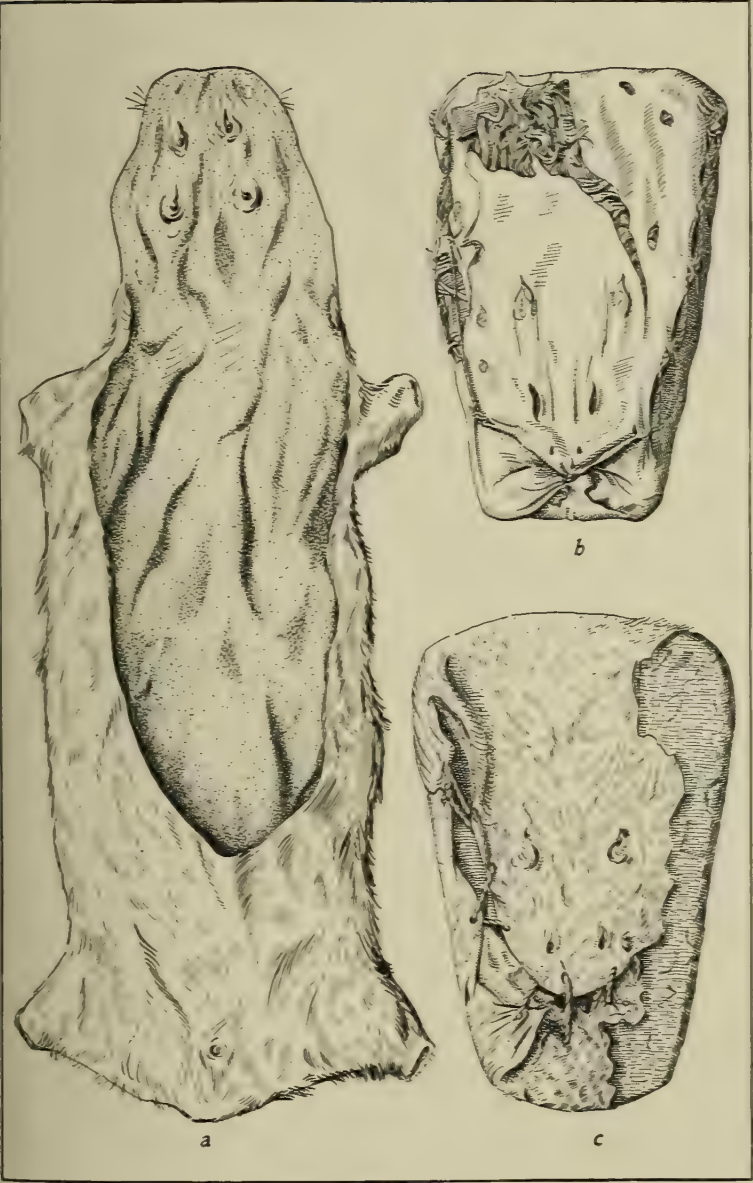
better pieces must have been watertight, it never attains the fineness of texture seen in many California coiled baskets. These ancient weavers strove, apparently, for strength and serviceability rather than for refinement of technic. No more stitches than necessary were used; hence the relatively great width of the individual sewing splints and their broad spacing, which allows the foundation to appear between them. The average tray basket has five coils to the inch and nine to eleven stitches along each inch of coil; the finest specimen has eight coils and twelve stitches; the coarsest, a fragment from a large pannier, has coils $\frac{1}{2}$ inch wide and six to seven stitches to the inch of coil. The edge bindings of all the baskets save one are in simple wrapping; the exception is a bowl-shaped piece (plate 23, i) in which the entire rim is finished in "false-braid" as in Navajo baskets.¹

Our specimens fall into the following five classes:

- | | |
|---------------------|--------------------|
| 1. Trays | 4. Water baskets |
| 2. Bowls | 5. Trinket baskets |
| 3. Carrying baskets | |

Trays. This is by far the commonest type. The examples are very flat, and run from 12 to 24 inches in diameter. They were probably used for the serving of food, and perhaps in gambling. One tray (plate 23, j) obviously had another purpose; about its rim at equal distances apart were four loops, two of which remain (the others were in place when found, but soon crumbled away). Each loop is made of a twig tied into a circle 2 inches in diameter and is attached to the rim of the basket by a short buckskin thong. The whole interior of the tray shows much wear, particularly severe at the bottom where, indeed, it had begun to give out and was reinforced by over stitching with new splints, which themselves were partly worn through. The outside and bottom exhibit no wear at all. It seems likely that this basket was suspended by the loops and used for the simultaneous hulling and winnowing of seeds too delicate to be shelled in a mortar. The process might have been to keep a stone rolling among the seeds by shaking the suspended tray, and to blow off the hulls as they were detached by

¹ For details of this stitch, see Mason, 1904, figure 197. A Basket-maker basket from Grand Gulch, in which the last inch of the terminal coil is done in "false-braid" is mentioned by Pepper (1902, p. 16); exactly the same treatment appears in a basket from Step House, Mesa Verde (Nordenskiöld, 1893, plate XLIV, 4); Diegueño and Kawia (southern California) tray baskets also have the last inch of coil in "false-braid" (Peabody Museum Collections).



WHITE DOG CAVE

a, Covering for umbilical pad; b, c, Umbilical pads. (About $\frac{1}{2}$.)

the bruising of the stone. This explanation is, of course, pure guesswork, but it seems to account satisfactorily for the presence of the loops and for the excessive wear on the inside.

Bowls. As will be seen in the illustrations (plate 23, a, c, f) these baskets are of lesser diameter than the trays and of much greater depth; their bottoms are flat and the sides rise more or less steeply. The largest is 14 inches wide at the mouth, by 8 inches deep. We believe that some of the larger bowls were used for boiling by the hot stone method, as two examples are heavily daubed with a mixture of mud and ashes applied, apparently, to render them watertight; they also have a soiled and battered look and many patches that indicate hard use.

Carrying Baskets. These are the largest of the coiled baskets, measuring 28 to 30 inches in diameter at the top, by 17 to 20 inches deep. They have pointed bottoms, oval in cross-section; and widely flaring upper parts (plate 23, k, l). By actual count of coils and stitches to the inch these are the coarsest of the baskets, yet they are as carefully and regularly woven as the finest; are very strong, but flexible enough to adapt themselves to the curves of the neck and shoulders of their bearers. There is no doubt that they served as panniers for carrying loads on the back; their shape and the use of similar forms by modern tribes are sufficient indications. The identification, however, is rendered certain by the fact that they all have pairs of loops, usually of human hair string, worked into their sides at the proper height for the attachment of head bands. In two specimens these bands are still in place. The common use of these panniers to cover interments is, of course, a secondary one.

Water Baskets. The excavations of 1916-1917 produced no whole specimen of this type, yet fragments of oval bottoms of a finer weave than is usual in panniers seem to indicate that such baskets were not rare. A fine example from Cave II, Kinboko, is figured in our former report. Dimensions: total height 17 inches, greatest diameter $14\frac{3}{4}$ inches, orifice $4\frac{1}{2}$ inches. It has an elongated base, oval in cross-section. The upper part flares out and becomes round; it is constricted again at the top, and the orifice is small. There does not seem to have been a neck, but there is some evidence that there was once a string-hinged cover. On opposite sides, just below the point of greatest diameter, are pairs of carry-

ing loops made by twisting into a heavy cord eight or ten two-strand human hair strings. The entire inner surface of the basket is thickly pitched with piñon gum, and the same material has been daubed on such parts of the exterior as had begun to wear through. A design of small stepped units may be faintly made out on the upper curve.¹

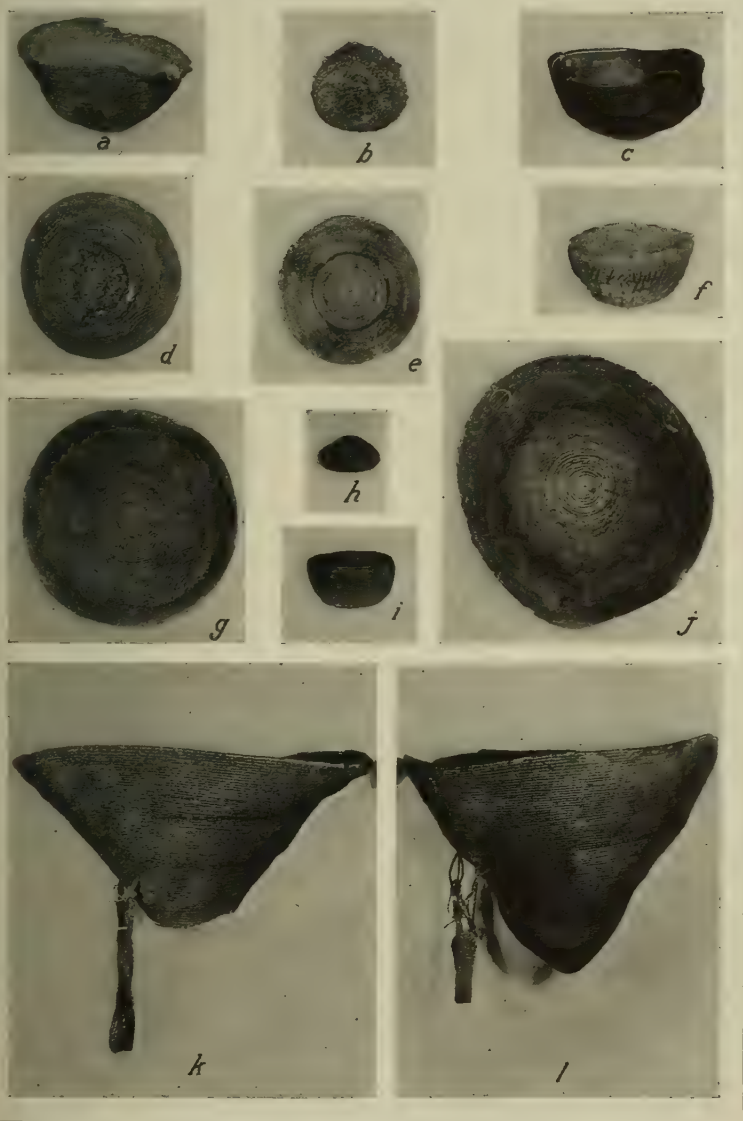
Trinket Baskets. These are neatly made little receptacles with round bodies and small orifices. The range of sizes and shapes is shown in the illustrations (plates 23, h, and 24, d). It is probable that these baskets were put to a variety of uses; many of those found in the graves contained small trinkets of one sort or another.

Decoration. Baskets of all the above types were ornamented with designs in black. Red elements, reported by Pepper² in Grand Gulch baskets, are not found in our collection. The designs are of great interest because they are without much doubt the oldest examples of basketry ornamentation that have yet come to light in the United States. Furthermore, they illustrate the decorative art of a people who preceded the pottery-making tribes of the region, and so may eventually be expected to throw light on the vexed question of whether or not southwestern pottery designs developed from those of basketry. We give, accordingly, all the decorations that are sufficiently well-preserved to copy (plate 24). These, together with the fine series of baskets figured by Pepper,³ will give the reader a very good idea of the make-up of the designs. Descriptions of the patterns tell no more than do the pictures, and any attempt to supply symbolical meanings to designs as old as these would naturally be pure guesswork. We have made notes towards a comparative study of these and the designs of the baskets from the Plateau and Pacific Coast areas, but they are as yet far from complete, nor have we space in this publication to present the mass of data which has already accumulated. It may be said, however, that the art as a whole seems to find its nearest parallel in that of the central and northern California tribes. In technic, on the other hand, the baskets most closely resemble those of the Paiute.

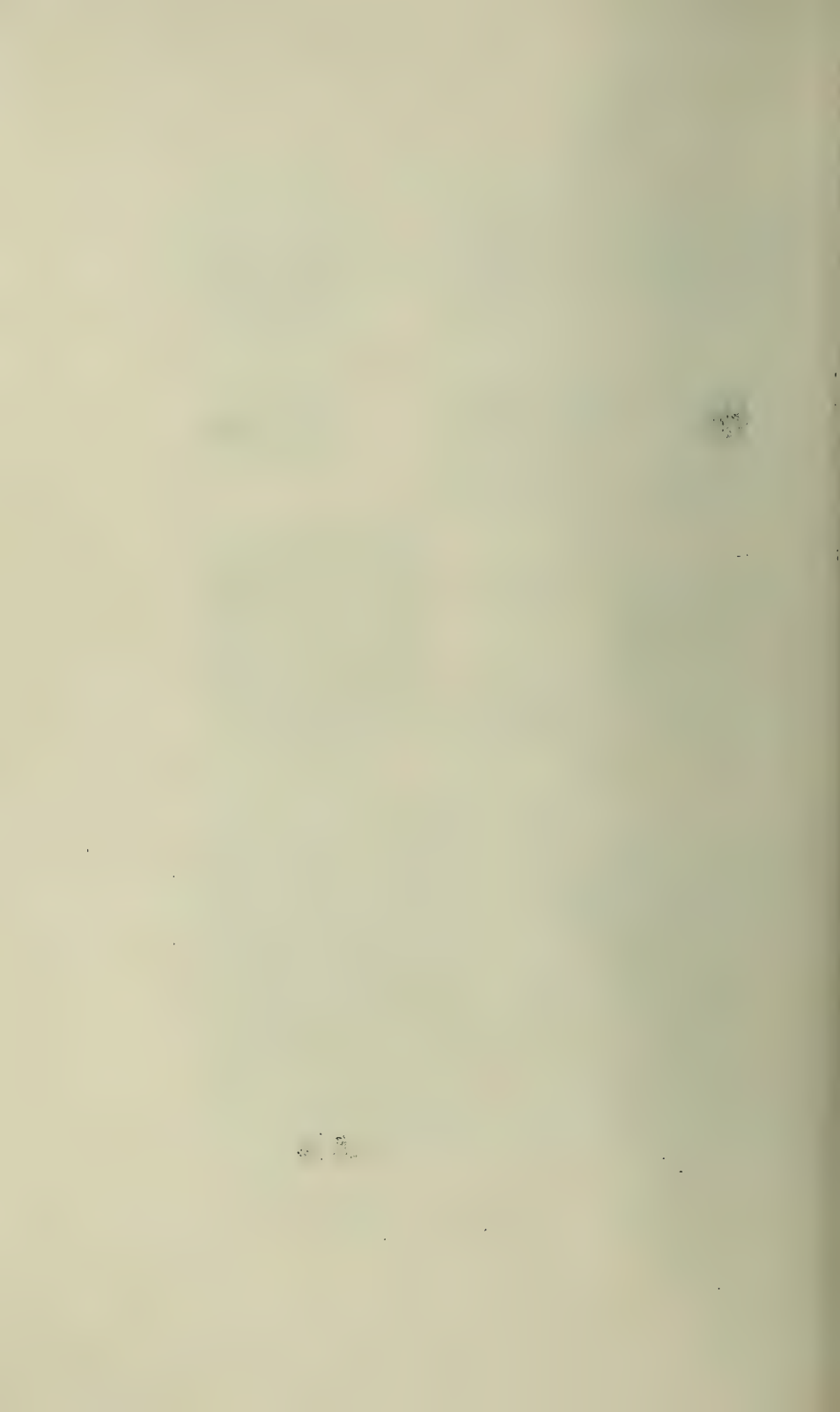
¹ Kidder-Guernsey, 1919, p. 170 and plate 78.

² 1902, p. 15.

³ Ibid., the same pictures may also be found in Mason, 1904, a more accessible publication, plates 84, 104, and 205 to 211 inclusive.



Baskets: All from White Dog Cave with the exception of h, which is from Cave 1, Kinboko Canyon, Marsh Pass. (About 1/16.)



Twilled Basketry. The only specimen in this weave is a flexible bag-like basket of yucca leaves with flattened spherical body and small mouth. Although it is fragmentary, the following measurements are approximately correct: width $8\frac{1}{2}$ inches; depth $4\frac{1}{2}$ inches; diameter of aperture 4 inches. It is made of entire leaves of *Yucca angustifolia*; the butts of the leaves are turned outward over a heavy fiber cord that rings the mouth of the basket, and are fastened by twined strings. The long ends of the leaves are then plaited together, over-two-under-two, to form the body. The bottom is not woven, the last couple of inches of the leaves being simply laid across each other and tied in that position with string (plate 23, b).

Although the over-two-under-two weave is the same, this specimen is entirely different from the twilled ring baskets so abundantly found in cliff-houses.¹ The latter are always bowl-shaped and have a wooden hoop at the edge. They are fabricated upwards from the bottom; not, as in this case, downwards from the rim. No trace of ring baskets has yet come to light in our excavations in Basket-maker caves; a bit of twilled work found in Cave 1, 1915,² was probably part of a flexible bag-basket like the present one.

TEXTILES

Plain Weaving. As the collection of Basket-maker textiles described in our first report contained no example of straight over-and-under weaving, we believed that the Basket-makers practised but two technics, namely twining and coiled-netting (coil without foundation). Among the material collected in 1916-1917 there are, however, three pieces of plain over-and-under weave. The largest of these is the cloth outer wrapping of the infant from Cist 13, White Dog Cave. Though much torn and showing long use, enough remains so that by arranging tattered ends of selvage in their proper positions one dimension is shown to be $27\frac{1}{2}$ inches. The other, based on extending the design to a symmetrical termination, would be 26 inches. It is probable that allowing for error in these measurements the original piece was square. The general appear-

¹ See Kidder-Guernsey, 1919, p. 108 and plate 43. The specimens figured by Pepper (1902, p. 23) are probably not Basket-maker, particularly as one of them was found filled with beans; the basket shown on p. 25, however, seems to be identical with the one under discussion.

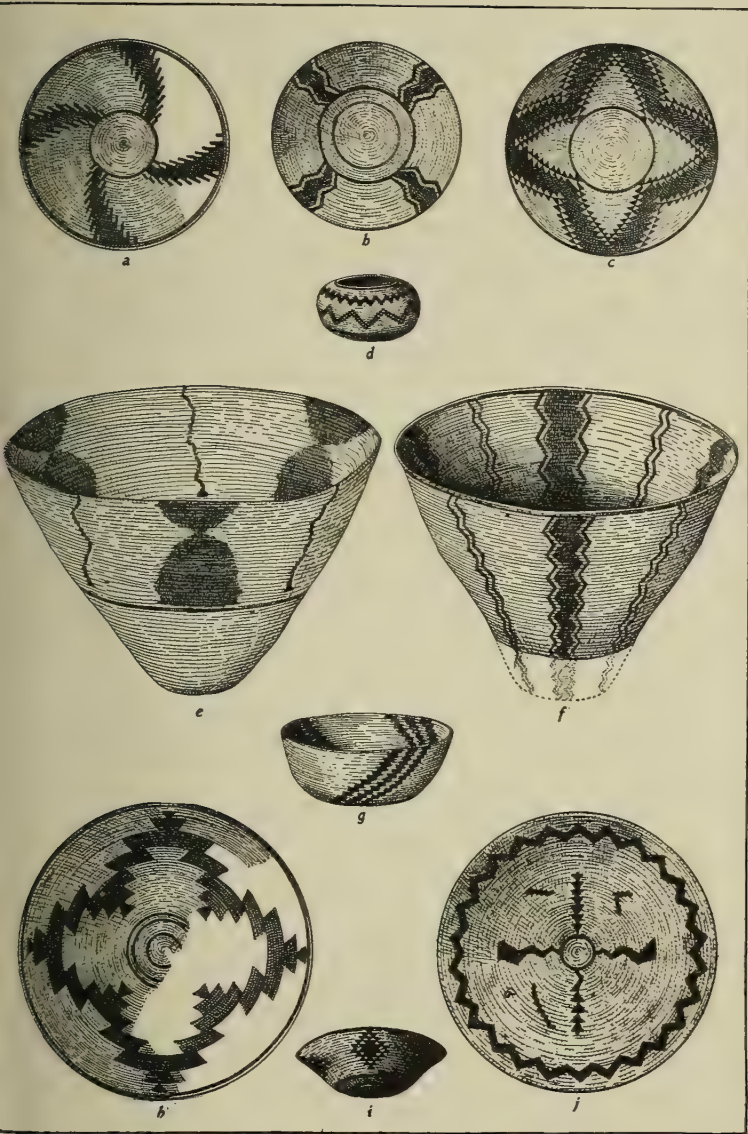
² Kidder-Guernsey, 1919, p. 167.

ance of the fabric is the same as that of the twined-woven bags both in color and design, the difference in technic not being apparent at first sight. The weave is rather coarse, having nine warp and fifteen weft strands to the inch. Both warp and weft are of a uniform sized two-strand twist of rather coarse vegetal fiber presumably yucca. As far as it is possible to work it out from the scant material at hand the weave is as shown in the diagrammatic drawing, figure 11, b. Details as to the manner in which the warp edge is finished appear in figure 11, b, and plate 25, c. The warp ends are cut close and the weft kept from unraveling by a buttonhole stitch. The edge running parallel to the warp is finished by twining two fine strands of human hair through the loops that result from turning back the weft for a new start; this also is illustrated in figure 11, b.

In the photograph, plate 4, a, there is seen at one point a circular hole, cut in the fabric, and finished all around by overcasting with fiber thread. The design (plate 26, b) consists of a series of large rectangles arranged in three rows, the two outside rows red, the center one black. The units average $2\frac{1}{2}$ inches long by $1\frac{1}{2}$ inches wide. Separately dyed elements were not introduced to produce the design; but apparently, when the weaving reached a point where a change of color was desired, the weft strand was thoroughly rubbed with color for the required length and then woven in. The warp cords show little color, such as appears on them probably resulting from contact with the weft. It is possible that the finished piece may have been treated with some mordant to fix the dye.

The second example of this weave is a fragment 12 inches long by 2 inches wide in very bad condition, one end showing darning. It is also from White Dog Cave. There are traces of a broad design in red, the exact character of which cannot be determined. The piece appears to be a part of a blanket very similar to the one just described. There remains a short section of one edge finished with a thread of human hair twined through the weft loops.

The third piece, from Cave 11, Sagiotsosi, was found with the disturbed burial described on page 37. It is very evenly woven with fourteen warp and twenty-one weft strands to the inch. The fragment has a length one way of 12 inches, and is a part of one corner of the original piece, so that two edges remain. Both warp and weft edges are finished in the same manner as the one first de-



Baskets: All from White Dog Cave with the exception of d, which is from Cave 2,
Kinboko Canyon, Marsh Pass. (About 1/16.)

scribed: a buttonhole stitch of fine string, and human hair twining thread respectively. The design is in red and black, and so far as it can be traced is shown in plate 26, c. It is painted, not woven, and the color was applied only to one side of the cloth; the red pigment has soaked through the fabric and the red parts of the design appear faintly on the back. The black paint has not soaked through at all. To the corner is tied a dressed leather thong, which leads us to think that it may have been part of a garment.

These fabrics remind one strongly of the Coahuila cave textiles, many of which are large poncho-like blankets woven in the same

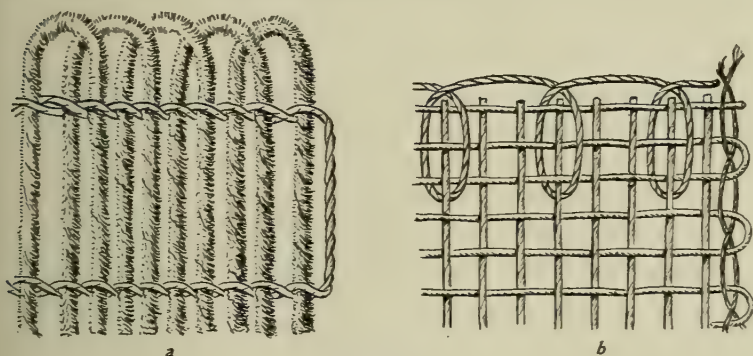


FIGURE 11

a, Detail of weave, fur cloth blankets; b, Plain woven cloth, detail of weave and selvedge.

way as these, and also have one edge finished with the buttonhole stitch. The latter resemblance seems significant, since we have not been able to find in the Museum collection textiles from any other region so finished. The designs, it is true, are different, though some of the elements seen in the Basket-maker twined-woven bags are also found in the Coahuila blankets.

The zigzag lines seen in the second specimen (plate 26, c) are very similar to the zigzags painted on the breasts of certain square-shouldered Basket-maker pictographs from the Monuments.¹ This resemblance has suggested to us that these woven fabrics may have been used as shirts.

Twined Weaving. The bags illustrated on plates 26, 28, and 30 form one of the most interesting groups in the collection, not only

¹ Kidder-Guernsey, 1919, p. 197, figures 100, 101.

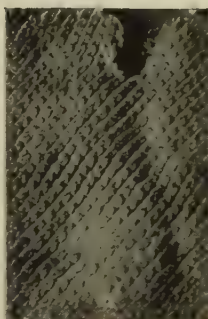
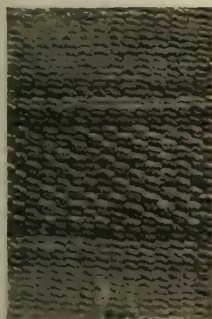
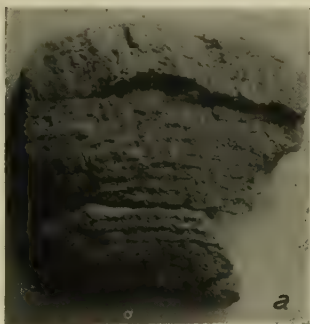
because of the excellence of their manufacture and the variety and beauty of their decoration, but also because they are so peculiarly characteristic of the Basket-maker culture. We have, fortunately, a large amount of material: complete bags to illustrate size, shape, and design; and great numbers of rags and fragments to make clear the details of technic.

The bags are flexible seamless sacks with full, round bodies and long, gradually constricted necks (plate 26, a, d). They range from $1\frac{1}{2}$ inches to 2 feet or more in length. All are made in the same way, of close twined weaving; the majority of specimens have both warp and weft of two-ply apocynum string, though some have yucca warp and apocynum weft. The combination of apocynum warp and yucca weft is rare.

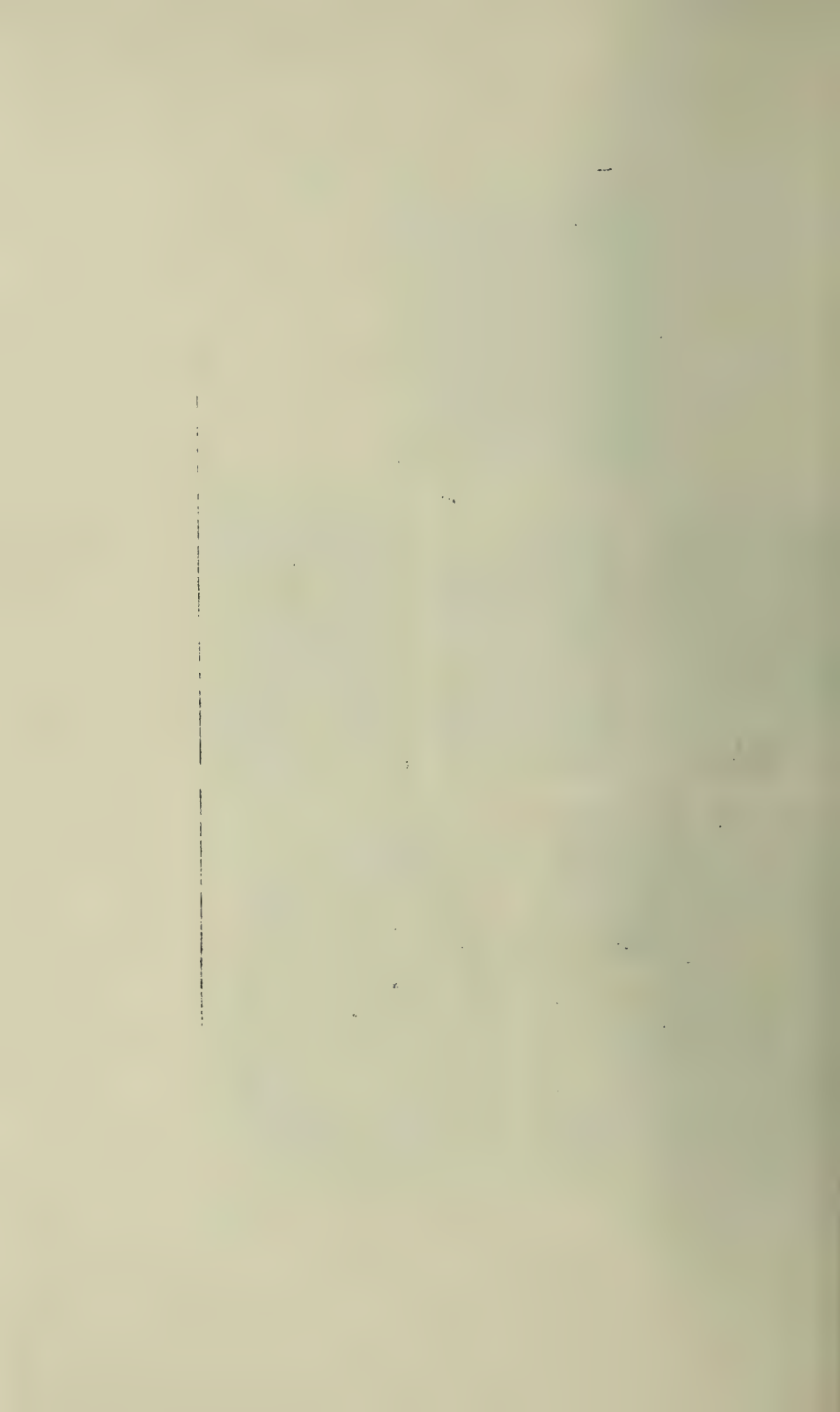
Our study of the weave was begun by examining the bottoms of the bags in order to make out how the preliminary "set-up" of the warp cords was accomplished. By dissecting several fragmentary specimens we found that there were two methods, one common, the other rare. The former was as follows: six long strands were laid across each other, three above and three below (figure 12, a); the middle strand of each set of three runs out straight, the others are bent so that their ends radiate from the common center. There are thus produced twelve original warps. The second method consists of twisting three strands about each other and then bending their ends so that they radiate and form six warp cords (figure 12, b).

The above systems are very simple and practical, and avoid the ugly lump and the potential weakness in the fabric which would have been the result of knotting the warps together at the base. The method of inserting the weft also obviates knotting: a single long string is worked over and under the radiating warp cords close about their common center; this is shown slack in figure 12, a, b; in reality it is pulled up very tight and holds the warp firmly together. When a circuit of the spoke-like warps has been made, the two ends of the weft string of course come together; they are then combined into a single strand of twined weaving, which continues spirally around and around to form the body of the bag fabric.

To return to the warp-skeleton. Many large bags have as many as three hundred and fifty warps at their point of greatest diameter.



a, Pottery, Cave 6; b, Twined-woven fabric, White Dog Cave; c, Plain woven fabric, Sagiotsosi Canyon; d, Coiled netted fabric, White Dog Cave; e-h, Necklaces, White Dog Cave.



It is obvious that these could not all come together at the bottom of the bag; hence the base begins with six or twelve warps only (as described above) and sets of new cords are introduced as the original ones radiate away from each other. Upon the number of new warps depends the size of the finished bag; and upon the rapidity of their insertion depends the degree of flare imparted to the base. If many new warps are added close to the bottom, the latter will naturally be very flat; if they are put in more gradually the bag will have an egg-shaped base. Figures 13, a, b, illustrate

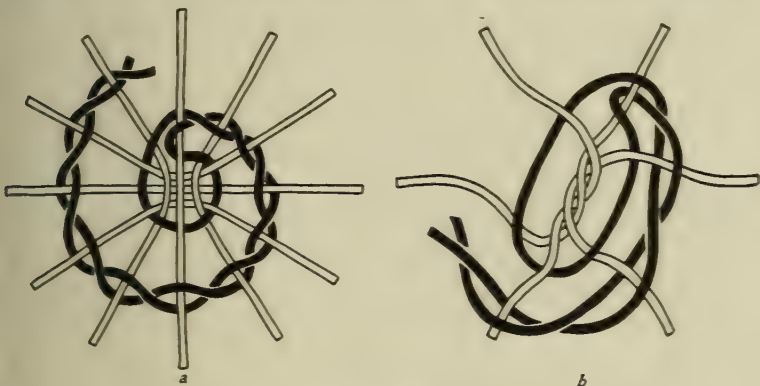


FIGURE 12

Methods of arranging and binding warp cords when beginning the construction of twined-woven bags. The weft cords are shown in solid black.

this; each one represents, diagrammatically, a circle about $1\frac{1}{2}$ inches in diameter at the bottom of a bag. In figure 13, a, the original twelve warp cords are multiplied to forty-eight by two series of insertions, the first or inner series consisting of twelve new cords, the second of twenty-four. In figure 13, b, the same total is arrived at, but there are three series of insertions; the first of six, the next of twelve and an outer one of twenty-four. Figure 13, c, shows an area of bottom no greater than in the former specimens, but containing seventy-six warps, set in as follows: original series twelve, first insertion series twelve, second series fourteen, third thirty-eight. The weft in all three cases is woven in with approximately the same degree of tightness; hence the warps of a and b are pulled close to each other and the bags have

narrower bottoms than in *c*, where the quicker insertion of warps allows the base to grow rapidly broader.

We have not yet mentioned the actual method of inserting new warps. Two ways were employed. In one (plate 27, *b*) the string to be added was looped and laid between two of the old warps (*b*, *b'*) thus forming two new ones (*a*, *a'*); the first two or three turns of the weft (*c*, *c'*) attach the new strands to the old warps on either side of them holding all firmly in place; the next turn of weft (*d*) takes in each new element separately and the weaving continues normally.

In the second method (plate 27, *a*), the strand to be added was doubled into a loop, making, as before, two new warps; the string

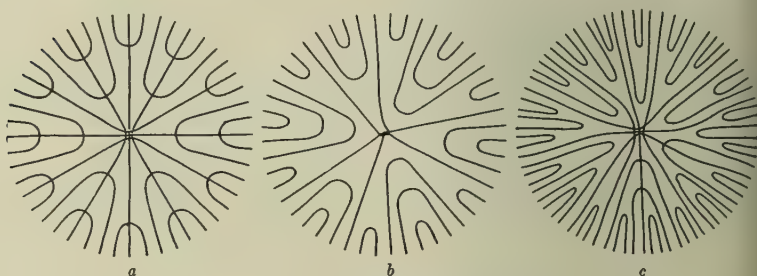


FIGURE 13

Methods of inserting new warp cords to increase diameter of bottom of bags.

at the bend of the loop was twisted apart into its two component plies and one of the old warps (*b*) was threaded through the resultant opening; the loop (*a*, *a'*) was then slid up the old warp and brought close against the last woven turn of the weft (*c*), thus producing a pair of new warps (*a*, *a'*) one on each side of the original one (*b*); on its next revolution about the bag the weft (*d*) takes in the two new warps and holds them solidly.

By the two methods just detailed the new warps become integral parts of the fabric without leaving any loose ends and without necessitating any disfiguring knots. The tension on the warps, however, incident to the use of the bags, tends to pull the loops very tight and so away from the last weft turn woven previously to their insertion, thus producing the little open space in the web indicated in the two figures. Where many new warp-pairs were introduced (as in the outer circle of figure 13, *c*) these little holes



Textile designs: a d, Twined-woven bags; b, c, Plain woven cloth.

naturally lie close together and make very characteristic open-workings about the bottoms of the bags.

The two different ways of adding warps (figure 13, a, b) are about equally common. In most bags either one or the other is adhered to; occasionally the two are mixed (figure 13, c). All bags seem to start with either six or twelve original warps, the ultimate size of the fabric depending on the number of new ones introduced; a medium-large bag (A-3054) had at its point of greatest diameter a total of about three hundred and fifty warps. Almost all specimens are more or less constricted toward the mouth; this is accomplished partly by tightening the twining of the weft and thus bringing the warp closer together, and partly by dropping out warps. A warp to be dropped is merely cut off and its end hidden by the next turn of the weft.

The final point in the study of the warps is the method of securing them at the edge or mouth of the bag to insure a strong and wear-proof selvage. This was sometimes accomplished by turning the warp ends about a stout edge-string (figure 14, a) and running them back a little way on themselves; they were held in this position by the last few turns of the weft; their loops about the edge cord were then pulled tight and the ends of the cords clipped off close to the fabric. In other cases the warp ends were looped under each other, then gathered into bundles of four or five, picked with an awl through the fabric just below the edge and finally clipped (figure 14, b). A third method also dispensed with the edge-cord: each warp was bent at the edge, paired with the warp next it, run back along it towards the bottom of the bag, held by the upper weft-turns, pulled snug, and clipped (figure 14, c).¹

We now take up the twining of the weft, which is perfectly simple and regular. It begins at the very bottom (figure 12, a, b) and continues in a close spiral to the mouth. Fresh lengths of weft string were not tied to the ends of the old ones (these weavers seem to have had a deep-seated aversion to knots), but were run a little way with them until firmly set. The entire weft, while made, of course, of many pieces, is thus essentially continuous. The method of procedure is unknown; it is probable, however, that the work was downward, the base of the bag having been attached

¹ Compare with a similar method of fastening warp ends in Cliff-dweller sandal heels (Kidder-Gernsey, 1919, p. 104 and figure 38).

to a limb or pole and the warps allowed to hang either free or tied in loose bunches to prevent tangling.¹ The twelve-year old daughter of one of the authors has experimented with this technique and has quickly become expert in making the bags. She holds the two weft-strings loosely across the palm of her hand separated by the index finger and gives the twist necessary to cross them between warps by merely turning the hand over. Each successive warp is hooked up and drawn between the wefts with the index finger. No tool is necessary for beating up the weft, as it

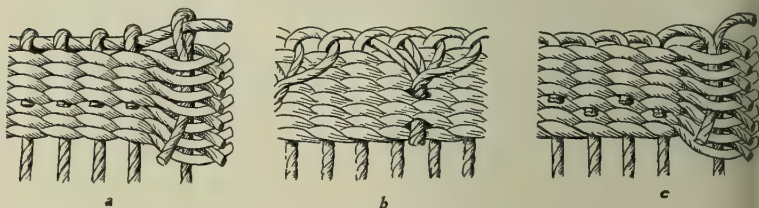


FIGURE 14

Various methods of finishing the top of twined-woven bags.

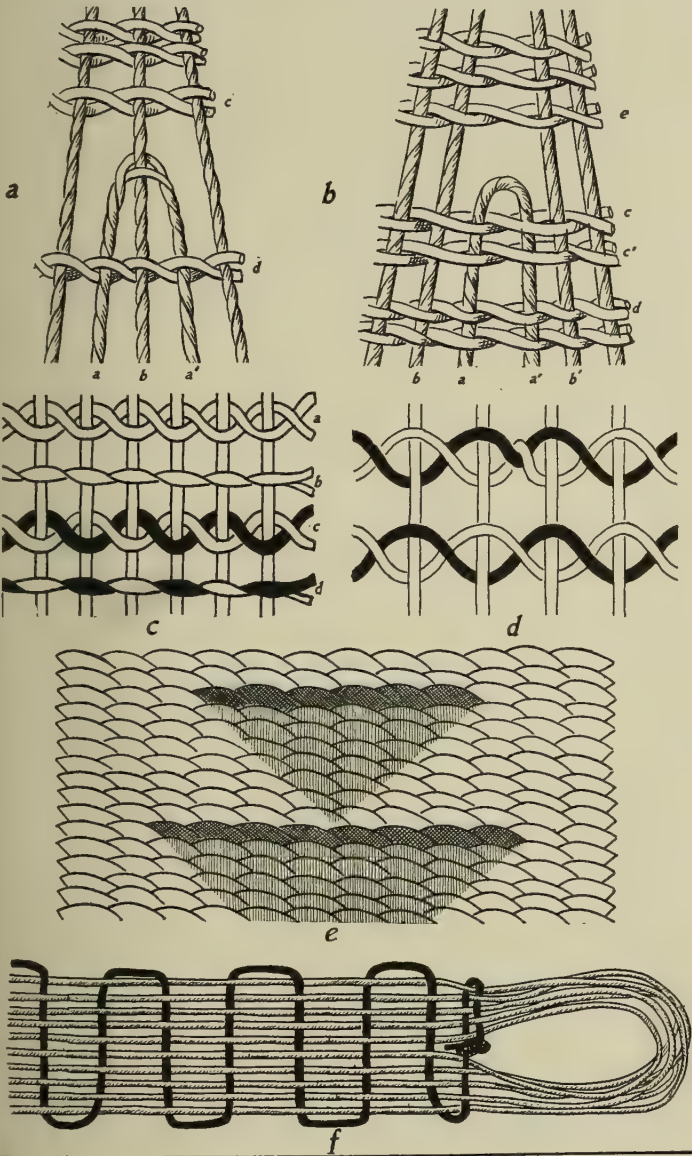
can be made to sit tightly by a slight pull after every few warp crossings.

The weave of the ancient specimens is very even, and the number of wefts per inch over the whole surface of any given bag is always practically the same, though the warps at the necks of constricted examples are pulled somewhat closer together than they are at the swell of the bodies. The coarsest weave in the collection (A-3005) has five warps and fourteen weft-pairs per square inch; the finest (A-3161) has fourteen warps and twenty-three weft-pairs. The normal texture lies approximately half way between these two extremes with about nine warps and seventeen or eighteen weft-pairs.

The decoration of the bags is no less interesting than their structure. There are two styles, woven and painted, both sometimes appearing on the same piece.

The woven ornaments were accomplished by what may be termed the "dyed weft" process. When a band of color was to be introduced a new weft-pair of the desired shade was not added,

¹ See a picture of a Virginia Indian woman weaving a bag-like basket, Mason, 1904, figure 148.



a-e, Details of twined-woven bags; f, Detail of plain woven carrying-strap.

but the weft then in use was itself stained or rubbed with dye for the requisite length and then woven in. While there is no reason why very short lengths of weft should not have been so colored and small unit figures thus produced, we have found no instance of the practice in the twined bags,¹ all the designs being in the form of bands completely encircling the bodies of the sacks. These bands are infinitely variable, but all are made in the same way and are very easily analyzed. To understand them one must keep in mind that in twined weaving a double weft is used, the two elements of which twine both about each other and about the warps. Each of the two elements crosses every other warp, hence all the warps are crossed (plate 27, c, a); and when the weft is pulled tight the warp is entirely hidden, each weft element (in the pair) appearing on the surface of the fabric over every other warp. If the two elements are of the same color the resultant line of weaving will be monochrome; if of different colors, the line will be "beaded," half of one color, half of the other (plate 27, c, d).

The bodies of the bags are woven of undyed apocynum, a warm yellowish-brown. The band designs are commonly in red, black, or a mixture of the two (plate 28).² The simplest are the single lines in solid black or solid red that encircle the bases of most specimens as shown in this plate. By introducing wefts with one black and one natural element, or one red and one natural, beaded lines are produced and these are combined to make up the great variety of bands shown in the illustrations. They are all narrow (the widest in the collection contains but twenty-four lines) and no two, except the simplest types (such as plate 29, c), are ever exactly alike. A favorite practice was to make a band containing both red and black as in b, of this plate, and then weave just above it the same band with the colors reversed. A little study of the detailed drawings in the plate will show better than any amount of description the nature of the patterns and the ways in which, by combining "beaded" and solid lines, the different vertical, horizontal and oblique effects were produced.

¹ Except as "markers" in painted designs (plate 27, e). See, however, the woven fabric (plate 26, b), where squares are made in this way.

² There is one specimen (A-3056) with a band in brown; this dye caused the string to which it was applied to rot rather badly. Another bag (A-3005) has two lines each one made of one red and one dark blue strand. The third case of the use of colors other than the conventional red and black, is the appearance of a few yellow lines in A-3470.

The type of pattern illustrated in e, is the only one which needs explanation. Normally the weave of the bags is counter-clockwise, and a series of " beaded " weft-rows produces an oblique design, whose lines run downward to the right as in a. By shifting the weave to a clockwise direction, the slant of the oblique lines is changed and they run downward to the left. The decoration shown in e, therefore, was made by introducing three clockwise rows, then six counter-clockwise, and finally six clockwise. There are but two examples of this style in the collection.

One further point should be noticed: the weft is continuous, going around and around the bag; if the number of warps were even, and if (for example) a weft-pair of one black and one natural strand were being used, the black strands would, at each successive revolution about the bag, cross the same warp, and a series of vertical black bars would be produced (as in the two upper rows of f). If on the other hand, the number of warps were odd, the emergences of the black strand on the surface would be offset at each revolution and the resultant design would be oblique as in a. As both types, vertical and oblique, often occur in the same band, as shown in d, it is obvious that when the change from oblique to vertical or vice versa was to be made the weaver had to employ some device to reverse the order of emergences of her alternating colors. How this was done is shown in plate 27, d.

Painting, the second style of bag decoration, would call for little notice beyond the illustration of the designs themselves, were it not for two very interesting peculiarities, namely, the practice of applying the designs to the inside as well as to the outside of the bags, and the use of markers woven in, apparently to aid in this duplication. These methods were employed in the decoration of the bag shown in plate 30, f, and restored in color in plate 28.

Perhaps the clearest way of presenting the technic is to describe the steps by which we arrived at an understanding of it. We had examined the bags a number of times and had always supposed, because the designs appeared on both sides of the fabric, that they had been woven in probably by means of the dyed-weft method; closer scrutiny, however, showed that the vertical and oblique edges of the figures were perfectly even and straight, not finely serrated or stepped as is always the case with such edges in a woven design. Under a magnifying glass the edges of the colored



WHITE DOG CAVE
Color-scheme of woven bag.

areas proved to be formed not by the stitches of the weave, but to run quite independently of them as illustrated in plate 27, e. This showed, of course, that the designs had been painted on, not woven in; but we were still at a loss to account for the accuracy with which they were reproduced on the reverse of the fabric (we had pushed pins through the weave at various juts and corners of the figures and had found that their points protruded at exactly corresponding places in the designs on the other side). We then decided that some dye must have been used which struck clear through the material and colored both surfaces. This explanation satisfied us until we chanced to pry apart some of the weft strings, and noticed that their under parts and the warps were not colored. This puzzled us greatly because we could not conceive of a dye which would act on both surfaces of a cloth without affecting its body. We then returned to our pin tests, and eventually discovered a few places where the designs on front and back failed to correspond by a small fraction of an inch, and one spot where there was an error of a quarter of an inch.

It was then clear that the two sides had been painted separately, but we could not understand how the elaborate patterns had been duplicated so exactly. Further examination cleared up this question also. We noticed that the top line of weaving in many of the colored units was of a darker shade than its body; on picking one of these upper lines out, we found that for the space necessary to cross the top of the design-unit, both its strands had been tinted before weaving in (weft-dyeing). These little colored lines or markers appeared, of course, on both sides of the fabric and must have made it quite easy for the weaver to paint identical patterns on each. They must also have been of great assistance in the original laying-out of the designs, for by introducing markers at regular intervals (ascertained by counting warps) along any single line of weft, regularity of spacing in a horizontal sense could be accomplished; by counting weft lines as they were woven upward from the one last marked and then marking a new weft, symmetrical vertical spacing could be insured (see plate 27, e; the shade of the markers is there exaggerated).

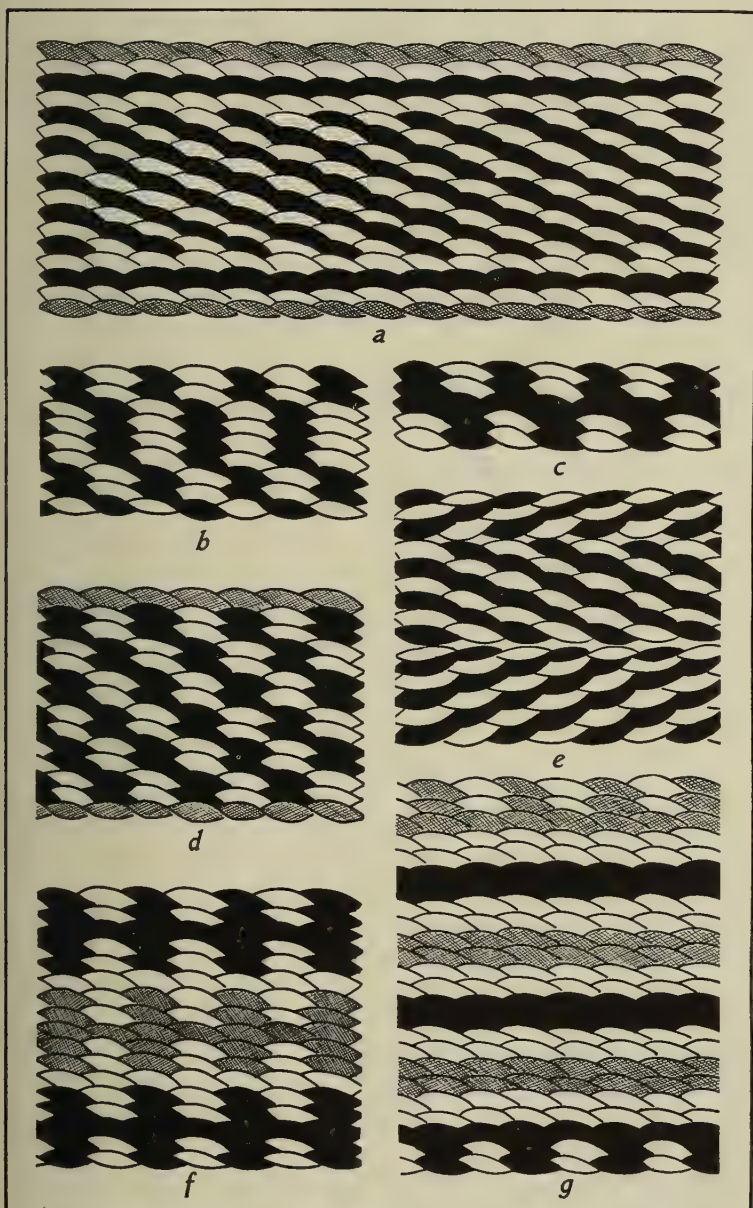
One further point: we experimented with water-color paints on bits of the bag fabric and found that it takes them without any blotting or running; furthermore the moisture in the paint (carry-

ing very little of the color itself) quickly soaks through and shows on the reverse side in sharply defined wet areas of exactly the same shape as the painted figures. By painting over these moist areas the decorator was still further aided in the accuracy of the duplication of the design.

This painstaking reproduction was accomplished on nearly all the painted bags in the collection; there are but few specimens decorated on one side only. Its purpose is not obvious, for while the bags are reversible, the weave being the same within and without, specimens showing long use are much more worn on one side than on the other. It seems, therefore, that the patterns on the inside were normally invisible. That they were so meticulously carried out may be due to the strong craving for perfection and love for detail possessed by so many primitive craftsmen; or it may have resulted from an equally common psychological trait, namely that of wishing to carry over into a new technic the qualities of an older one. To be explicit: it is likely that basket-making was practised by these people before they learned to weave this specialized type of bag; the painted patterns under discussion are also found woven in the baskets (compare plate 24 with plates 26 and 28); hence it may be that when painting such decorations, it was thought proper that they should appear on both sides of the fabric as in baskets.

Fur cloth. This was one of the most important textile products of the Basket-makers. Robes of fur cloth were presumably the usual overgarment for cold weather, were doubtless used for sleeping blankets, and were invariably wrapped about the dead previous to burial; young babies were provided with specially shaped fur cloth coverings (plate 4, b, f).

The strings that compose the body of the fabric were variously prepared. The commonest method was to wrap a yucca cord with narrow strips of the hide of small animals applied raw and with the fur on; deer and mountain-sheep skins, when used, were generally dressed. The strips were applied spirally, the end of one piece holding down the beginning of the next. The tight wrapping of the hide caused the hair to stand out in all directions, thus giving the finished string the appearance of a greatly magnified pipe-cleaner. Another way of making the string was to catch tufts of long, woolly animal hair (dog or buffalo) detached from the hide,



Twined weaving; designs produced by different manipulations of the weft-strands.

through the twists of a two-ply cord; the same was also done with small patches of skin from the heavily furred bottoms of rabbits' feet. Strips of tough skin with the hair on were sometimes twisted upon themselves instead of being wound about a cord.

The weaving process was very simple; the prepared string was wound about some sort of frame, or perhaps around a pair of long pegs driven in the ground. The winding was done in such a way as to lay each succeeding turn of the string parallel to and close against the preceding one. When the desired size was reached, the strings were fastened together by twined rows of yucca cord; finally, the frame was removed. To illustrate the nature of the selvages, a corner of one of these fabrics is shown in figure 11, a. The upper edge is composed of the looped turns of the single long fur-string which forms the body of the cloth. On the lateral selvage may be seen the method of bringing the continuous twining cords down the edge for a new crossing.

Due to the wide spacing of the rows of twining cord, the texture of fur cloth is very loose. The component string is, however, so fluffy and hangs so evenly between the twined cross-rows, that the finished blanket has a very smooth surface; it is also softer and more flexible than the best dressed hide. Pleasing blends of color were produced by mixing different kinds of fur; ornamental edgings and tassels were sometimes made by using bits of string wrapped with strips of downy bird skin; or strings between the plies of which were held pieces of rabbit foot fur, colored red.

Narrow Fabrics. Carrying bands were employed for the transportation of heavy loads. We have found them attached to the large pannier baskets (plate 23, k, l), and one accompanied the bulky bundle containing a hunting net discovered in White Dog Cave. It is probable that they were also used with cradles. They are long woven straps with loops at either end. Although individual specimens differ from each other in dimensions and in the details of weave and ornamentation, most of them are fundamentally alike in that they are made of a long cord looped into a flat skein and held together by a single binder, which runs over and under, back and forth across it. The binder terminates just before reaching the ends, thus leaving two loops for the attachment of the strap to the burden (see the diagrammatic drawing, plate 27, f). Ornamental patterns are sometimes introduced by making the

skein of strings of contrasting colors, or by using a binder of a color different from the rest of the fabric.

One of the straps found with a pannier basket (plate 23, k) is made of a single heavy yucca fiber string looped on itself twelve times to form twenty-four parallel elements; the binder is also of yucca. The length of the specimen is 22 inches, width $1\frac{1}{2}$ inches. The second pannier strap is longer, 32 inches, but of the same width. It is composed of yellowish fiber and black human hair strings, alternated to produce a simple design; the binder is yucca. There are also several fragmentary bands of the same weave, in one of which (A-3495) the one remaining loop is tightly wound with fine string.

The band found with the rabbit net (plate 31, c) is constructed on the same basic principle, but its binder, instead of being covered by the longitudinal strings, forms the surface of the fabric. In making this strap, a single stout yucca cord was looped four times, producing eight parallel strings; the binder is woven back and forth over and under these; it is a heavy cord twisted of a mixture of dog and buffalo hair, and is so fluffy and is beaten up so tightly that the underlying yucca strings are entirely concealed except at the ends, where they protrude to form short loops for the attachment of tie-cords. The specimen is 22 inches long and $2\frac{1}{2}$ inches wide.

Tape. Very narrow flat fabrics were made on the same general principle as the coarser carrying-straps, but the materials are finer and the weave more elaborate. They are rare, our only new example being a short length of tape $\frac{5}{16}$ of an inch wide which was found attached, apparently as a tie-string, to a large fur cloth robe enveloping mummy 1, Cist 24, White Dog Cave. It has parallel longitudinal elements and a single binder; the parallel strings are twenty-eight in number, arranged in fourteen pairs which twine about the successive crossings of the binder instead of merely passing over and under them as in the carrying-straps. The design, produced by mixing brown and white strands, is very similar to that of a tape found in Cave 1, 1915. In number of elements and in weave the two specimens are identical.¹

Rigid bands. We have only a single specimen of this type, but there is a very similar one from Grand Gulch in the American

¹ Kidder-Guernsey, 1919, p. 173 and figure 82.



Twined-woven bags. All from White Dog Cave with the exception of d, which is from Cave 6. (About $\frac{1}{2}$.)

Museum of Natural History in New York. Our example (White Dog Cave, A-3452) is composed of thirty slim, peeled willow twigs laid side by side to form a flat band $4\frac{1}{2}$ inches wide and held together by a tight, twilled over-two-under-two weave of fine string. The upper part of the cross-weaving is in human hair string, the lower of apocynum. The object is $9\frac{1}{2}$ inches long, but is broken off at both ends so that we cannot even guess at its original length, nor at the way in which it was finished.

NETTING AND CORDAGE

Coiled Netting.¹ A bag from White Dog Cave is our best example of this technic. It is a little apocynum string sack, 6 inches long, with rounded body and constricted neck. The stitch is very even and regular (plate 25, d); there are twelve coils to the inch and each coil has nine loops to the inch. The entire bottom of the bag is red; the neck is in natural color, encircled by narrow bands of red and brown. As there is no sign that new strings were introduced to make the changes in color, it seems probable that the entire fabric is made from a single long strand, which was stained or rubbed with pigment for the proper length whenever it was desired to produce a colored band.

Rabbit Net. This remarkable specimen, which, according to Dr. J. W. Fewkes, is probably the largest piece of ancient textile so far recovered in North America, is from White Dog Cave. When found it was rolled upon itself, partly wrapped in bunches of fiber, and tied into a neat bundle with yucca leaves. Undone and spread out, it proved to be a net 240 feet long, 3 feet 8 inches wide, and with meshes $2\frac{1}{2}$ inches square. It is in perfect condition and, except for a single strand which has at some time been burned through by a stray spark, is as firm and strong as the day it was made. The material is a two-ply twine of Indian hemp (*Apocynum cannabinum*), very firm and evenly twisted and about $\frac{3}{32}$ of an inch in diameter. An estimate of the amount of string composing the net gives approximately 19,581 feet, or very nearly $3\frac{3}{4}$ miles. Extending the length of the long edges and across the ends is a marginal cord, of stouter two-ply yucca string; the method of attaching this can be seen in plate 31. The mesh-knot is one that is

¹ This term has been suggested by Mr. Willoughby as a more appropriate one than Mason's "coil without foundation"; for a diagram of the weave, see Kidder-Guernsey, 1919, figure 45.

used almost universally. The entire net is of the same mesh, but there are two sections, one 9 and the other 6 feet long, in which human hair has been used with the apocynum fiber, one strand of hair twisted with one of fiber.¹ These sections are naturally of a darker color than the rest of the specimen. Strung on the cord of one of the meshes is a single olivella shell bead, another bears two stone beads; still another has attached to it a few downy feathers which may be seen in the plate; on a fourth is a small pink feather, and at a fifth place there is a paw of some small animal tied on with sinew.

Attached to the net when found was a carrying-strap of coarse dog or buffalo fur-string. Such a strap was no doubt needed for transporting the net, as the whole bundle weighs over twenty-eight pounds. The bunches of fiber that partly enclosed the rolled up net are of Indian hemp (the same material in its raw state as the twine); it is stripped up and tied in hanks in much the same manner as are the trade bundles of Indian hemp in the Peabody Museum collected from the Thompson Indians.

The method of using nets such as this is made clear by the following quotation from Powell:²

They (the Paiute) get many rabbits sometimes with arrows sometimes with nets. They make a net of twine, made of the fibers of a native flax. Sometimes this is made a hundred yards in length, and is placed in a half-circular position, with wings of sage brush. They have a circle hunt, and drive great numbers of rabbits into the snare, where they are shot with arrows.

It has occurred to us that the hair string sections, being darker than the rest, might have been intended to lure the quarry toward them, for, to a frightened animal they might appear to be openings.

Of interest because of its close similarity to the present specimen is a rabbit net in the Peabody Museum that was collected from the Paiutes about 1870 by Dr. Edward Palmer. Its length is 124 feet, width 4 feet. The mesh is practically the same, and the material is also apocynum fiber; furthermore, there are sections which appear darker than the rest of the body, though no human hair string is used. This net is provided with a number of light crotched sticks which were used to hold it upright when set. No such sticks were

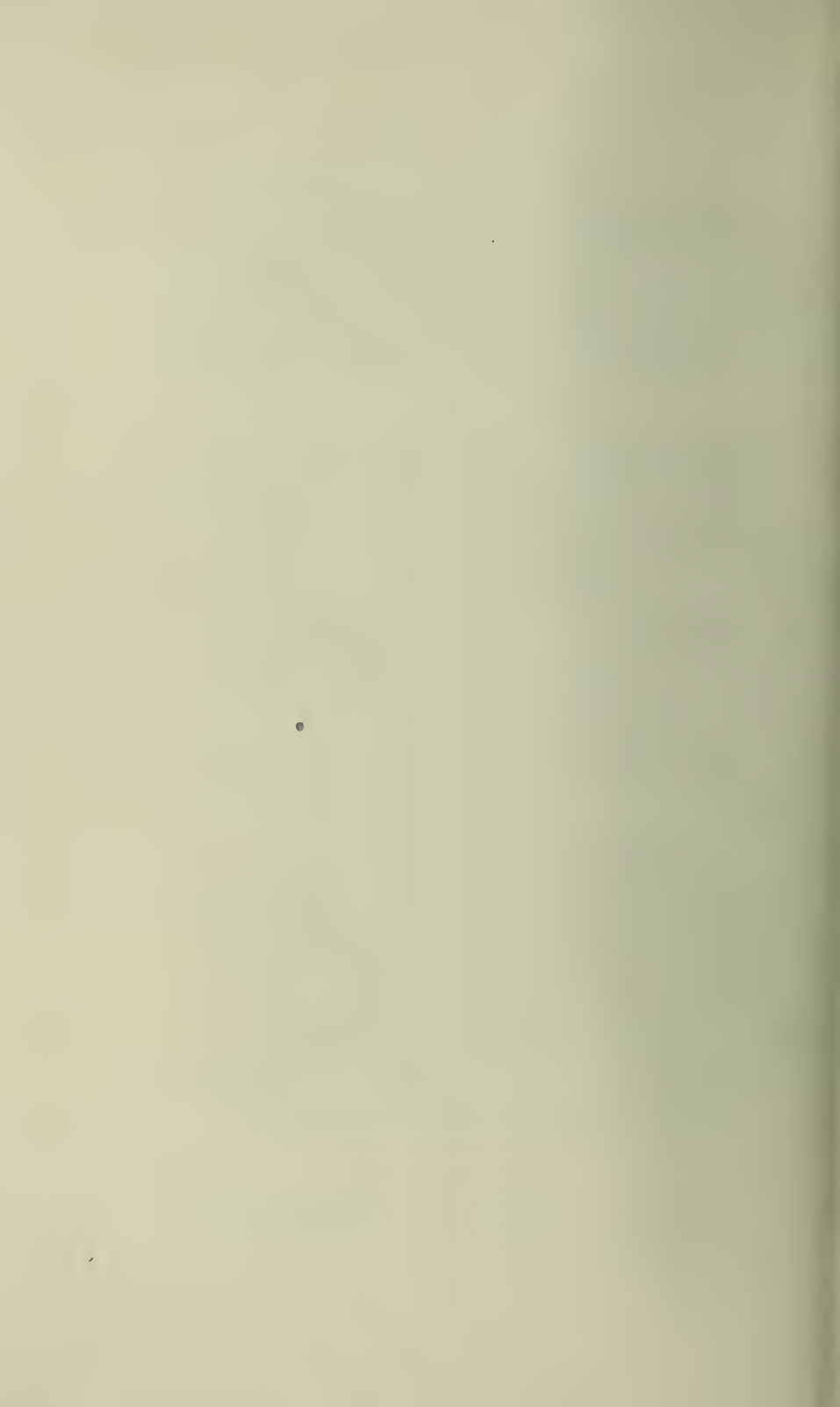
¹ From Cave 10 came a fragment of another net of the same weave and mesh size; this piece is also made of human hair and apocynum string.

² 1875, p. 127.



WHITE DOG CAVE

a, Umbilical pad; b, Gourd vessel; c, Rabbit-net, carrying-strap and bunch of fiber found with the net. (About 1/10.)



found with the specimen from White Dog Cave. In the collection from the caves of Coahuila, northern Mexico, is a fragment of netting similar to the above. Heye records a fragment of yucca rabbit net from a Diegueño cache pot.¹

Snares. The best preserved of the three specimens of snares found in Cave 6, measures 8 feet 6 inches in length and is made from twelve strands of twisted yucca fiber, braided into a rope $\frac{5}{16}$ of an inch square. At one end is a loosely tied knot, at the other a loop, 2 inches in length. This loop is not spliced or seized to the body of the rope, but is an integral part of it (plate 32, a). To accomplish this, a piece 7 inches in length was first braided with six strands, then doubled to make the loop, and the twelve strands thus brought together were braided to form the rope itself.

A second specimen made of the same material and in the same way measures 7 feet, 4 inches in length.

The third snare though made in the same way as the other two, is of a different material, probably apocynum fiber. The strands are more evenly twisted and the braiding so done as to give the finished rope a very smooth appearance. It is also more flexible than the others, and shows signs of considerable use. It was broken or cut into three sections when found. Attached to the loop of the noose is a fragment of coarse netting made of soft fiber string. Fastened to the netting at several points is a thread-like fiber string.

Tied to the noose of each of the first two specimens described is a short piece of twine, and a bit of netting made of similar twine was found loose in the cache. Attached to one end of this netting are four beads and a little pendant of a material resembling opal, very brilliant in the proper light. Of the beads, the one next to the pendant is of white stone and measures $\frac{1}{8}$ of an inch in diameter, and $\frac{1}{16}$ of an inch thick. It is very symmetrical. Another white bead of the same material is a thin disk. The third and fourth are discoidal in shape and $\frac{1}{4}$ of an inch in diameter; one is made of a green stone, the other of shell, *Spondylus calcifer*.

The use of snares of this kind is not confined to any one region, but appears to have been general where game, such as deer, antelope, or mountain-sheep, was found. The Pomo Indians employ a similar contrivance, the noose, when set, filled with coarse netting.

¹ 1919, p. 45.

Lumholtz describes and figures a snare used by the Huichol Indians of central Mexico, which is set with a netting across the noose opening.¹ Waterman illustrates a Yahi deer snare of the same type as those under discussion, but without the netting.² It is probable that the Cliff-dwellers also used snares, as one of a series of pictographs found near Ruin 5 by the 1914 expedition depicts a man in the act of throwing a noose over the head of a mountain-sheep.³

The netting with which the noose was filled no doubt made the trap more effective, as it could be set to cover a much wider space in the runway. The animal in pushing its way through the net would draw the noose tight about its neck.

The method of braiding a rope square is also widespread and has survived into modern times as in Navajo leather riatos. Examples are found principally in regions where the lariat is used, though the Northwest Coast tribes braid ropes in this way for their harpoons and other fishing devices, as do the Mohave for neck strings.

A running noose probably designed for a snare is the clever little device illustrated in plate 32, b. The braided loop is replaced by a short section of hollow bone, neatly cut and seized to one end of the string with sinew. This makes a very free-running noose.

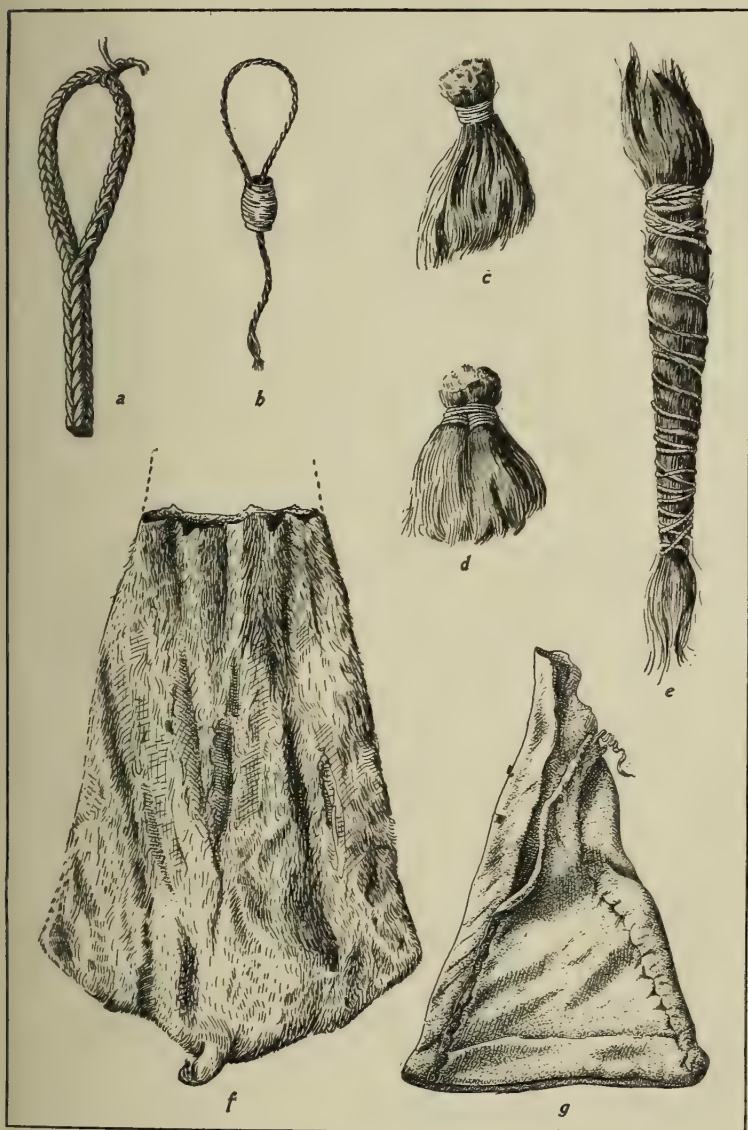
OBJECTS OF WOOD

Atlatl or Spear-thrower. The atlatl is a device which serves to add greater length, and therefore, greater propulsive force to the arm of the thrower in launching a spear or dart. It consists of a long, thin stick with a grip for the hand at one end, and a hook-like spur to engage the butt of the spear at the other. In throwing, the butt of the spear was placed against the spur at the end of the atlatl; its shaft lay flat along the atlatl with its point projecting in front of the user's hand; it was held in this position, probably near its middle, by the second (fore) and third fingers which passed through the loops of the atlatl on the sides of the grip. The fourth and fifth fingers were clenched upon the atlatl grip below the loops, holding it firmly against the palm and heel of the hand. The base of the thumb served to solidify this grip on the atlatl,

¹ Lumholtz, 1903, Vol. II, p. 41.

² Waterman, 1918, plate 13.

³ Kidder-Guernsey, 1919, plate 93, b.



a, b, Snares showing details; c, d, e, Bunches of human hair; f, g, Skin bags.
 b, c, d, f, g, White Dog Cave; a, Cave 6; e, Cave 14. (About $\frac{1}{2}$.)

and the thumb proper aided to steady the spear in its resting place between and upon the second and third fingers.¹

The atlatls illustrated in the plate were all found with burials in White Dog Cave. The finest of these, plate 33, b, c, had been broken nearly in two before it was placed in the cist. It is made of oak, carefully worked down and almost polished. The length over all is 25 inches. The front or spur side is nearly flat, except for the short distance between the spur and the distal end, where the middle is a little higher than the rest of the surface. The sides are rounded and the back is slightly convex. The distal end terminates in a blunt point. The spur is set at the head of a short deep groove, the bottom and sides of which show plainly the marks of the sharp stone tool used in excavating it. At $3\frac{1}{2}$ inches from the rounded proximal or hand end the two sides of the stick have broad notches; these notches lie between the finger-loops. The latter are made of a single strip of heavy dressed hide folded lengthwise. Through the middle of this folded piece there is cut a longitudinal slit just large enough to allow it to be pushed up over the atlatl shaft to its proper position at the lower end of the side grooves. The two flaps are brought forward and down until they touch the stick at the upper end of these grooves, where they are securely fastened with strong sinew sewed through them, and then wrapped around the shaft. On the back of the atlatl there is a thong which is looped through the slit in the grip, brought forward and seized to the shaft; this served to hold the strip in place and to keep the finger loops properly extended.

Tightly lashed to the back of the atlatl, as shown in the drawing, are three beautifully worked greenish stones of elongated loaf-shape, flat where they lie against the wood, their upper sides sharply convex. All three are fashioned from a substance identified by Professor J. B. Woodworth as a fossilized mammalian tooth.² The entire shaft, from the binding which holds the upper stone to the finger-loop attachments, is coated with a thin layer of resinous gum, applied before the stones were tied on, but afterwards renewed on the front side, where it covers the seizing of the middle one.

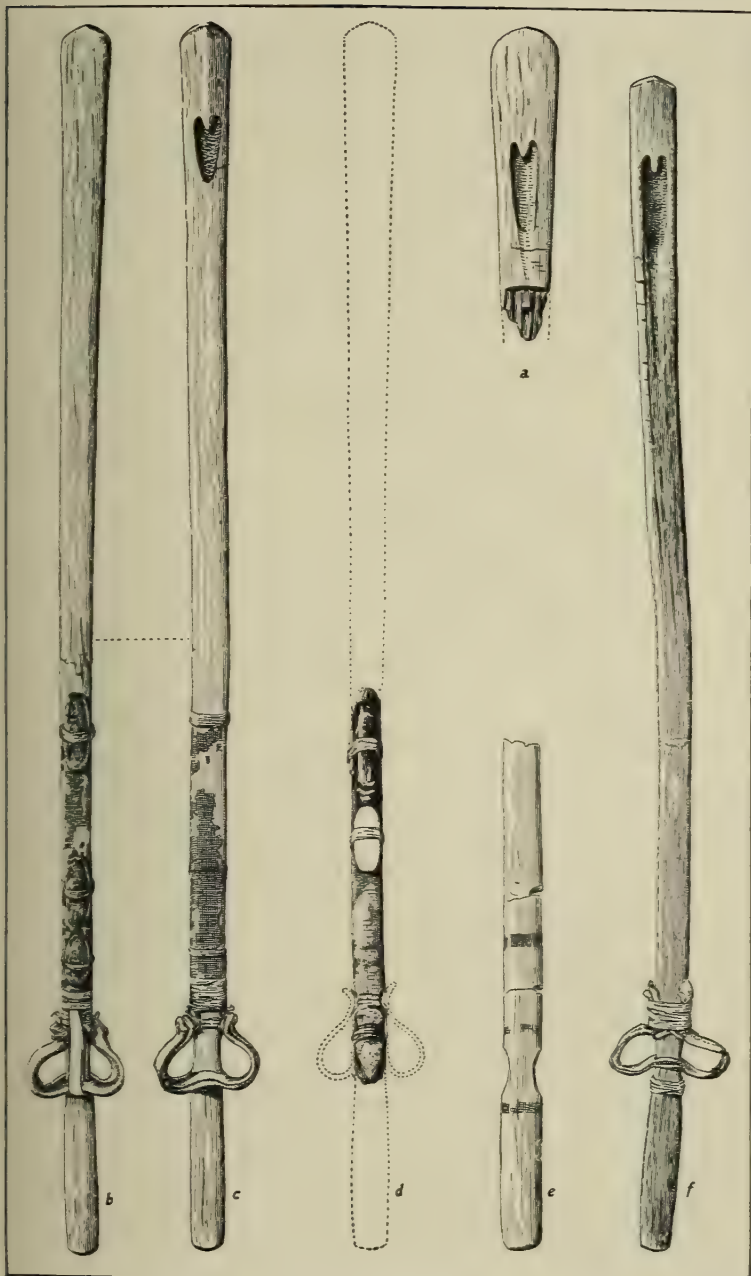
¹ See Kidder-Guernsey, 1919, figure 87.

² An unworked fragment of the same material was found in a bag in Cave 6; see plate 44, b.

The second atlatl (plate 33, f) is somewhat less well-preserved, its oak shaft being checked and a little shrunken, and the finger-loops dried stiff. The lateral curve of the stick is probably due to warping. The total length is $23\frac{1}{2}$ inches. The spur is slimmer and sharper than that of the specimen just described; and the groove, instead of being deep and short, is shallow and runs nearly 5 inches down the shaft. The finger-loops are straddled as before, over a pair of broad notches in the side of the stick; they are made by folding a buckskin strip, slitting it in the middle, and drawing it over the shaft, to which the ends are attached by a cross-binding and an over-wrapping of sinew. The slit middle part is kept from slipping backward by an annular seizing. Ten inches from the butt there may be seen on the front (illustrated) side of the weapon the print of a former ligature; on the back there is a light colored oval mark corresponding exactly in size and shape to the flat base of a chipped stone (plate 35, f) found loose in the same cist. These traces indicate, of course, that the stone was once attached to the back of the weapon.

The next atlatl to be considered is a fragmentary one, shown in plate 33, d. The part recovered is a section of the shaft $7\frac{3}{4}$ inches long extending forward from the former seat of the finger-loops. To the back is attached an elaborate series of "weights." The specimen was found, done up with other objects, in a skin container that was tucked between the outer coverings and the fur cloth robe of mummy 2, Cist 24. Both ends are bruised and rounded, indicating that the piece was used in some way, perhaps as a ceremonial object or as a fetish, for a long time after the original weapon was broken.

In size and shape the fragment differs little from corresponding parts of the atlatls described above. The side grooves under the missing finger-loops are shallower; and there are a pair of notches just forward of these, which once held the fastenings of the front ends of the loops. Of the attached "weights," the lowest is a small triangular chipped point, $1\frac{3}{8}$ inches long and $\frac{5}{8}$ of an inch wide; its lower side is flat, so that it fits snugly against the stick, the upper side is somewhat rounded. The sinew wrappings which hold it pass about the shallow finger notches. Two and three-quarters inches above the chipped point there is a flat oval piece of white limestone, $1\frac{3}{8}$ inches long, $\frac{1}{2}$ inch wide, and $\frac{1}{8}$ of an inch thick;



WHITE DOG CAVE
Atlatls or dart-throwers. (About $\frac{1}{2}$.)

it is very neatly made and is well polished. Almost touching this is a polished, loaf-shaped piece of dark green satin spar, 2 inches long. Pushed under the sinew binding that holds the latter in place is a section, 1 inch long, broken from a round skewer-like bone object, perhaps from a pin such as was used in making hair ornaments (plate 18, b). A dark, pitchy stain covers that portion of the shaft to which the objects just described are attached, and is smeared over the sinew wrappings of the two forward ones. Adhering to the stick when found were some downy feathers, but it is not certain that they had not become stuck to it accidentally.

The two remaining figures of the plate show pieces of broken atlatls. The butt fragment has two narrow notches on one side below the finger-grooves, a feature not observed in any other specimen. Ligature prints of the finger-loop attachments, and also of a "weight" binding may be seen. The broken distal end is the heaviest and broadest one in the collection; it measures $1\frac{3}{8}$ inches across; the groove is $2\frac{3}{4}$ inches long.

Darts. The darts cast with the aid of the atlatl consisted normally of two parts: a long main-shaft, feathered at the proximal or butt end; and a short foreshaft set into the tip or distal end of the main-shaft. Heretofore there has been little accurate knowledge as to the main-shafts, the material recovered having been very fragmentary. The expedition of 1916, however, yielded three nearly perfect specimens, as well as a number of less complete ones, from which additional details can be learned. These were all found with burials, and had, on account of their length, been broken before being placed in the cists.

The three entire shafts referred to above were in halves when discovered; mended they measure exclusive of foreshafts, $52\frac{1}{2}$, 55, and $55\frac{1}{2}$ inches long. The tips or distal ends are the heaviest parts averaging $\frac{1}{2}$ inch in thickness; from this maximum diameter there is a gradual taper to the butts or proximal ends, which average $\frac{3}{8}$ of an inch through. They are made of straight, slender branches of some light wood with a small pithy heart; the bark has been carefully removed, the twigs trimmed close, and in some cases the knots have been further eliminated by rubbing. The large ends of some shafts have a very slight terminal taper (plate 34, h), and the edges of the butts are rounded. One specimen has marks on

its surface such as might have been caused by using a shaft-straightener of the wrench type.¹

In the distal or large end of the shaft is drilled a cone-shaped hole $\frac{5}{16}$ of an inch in diameter at the mouth and 1 inch to $1\frac{1}{4}$ inches in depth; into this socket was fitted the butt of the foreshaft as in j. In order to prevent the socket from being split open when the foreshaft was driven back into it on impact, it is reinforced by outer ferrule-like wrappings of stout flat sinew as shown in the drawing. The proximal or butt end of the main-shaft is provided with a shallow cup, b, to engage the spur of the throwing stick, and here again there is sometimes applied a band of sinew to prevent splitting.

The method of winging the shafts can be accurately reconstructed from the material at hand. As shown in a, b, three feathers possibly somewhat trimmed, but with unsplit quills, were laid along the shaft and seized to it at both ends with flat sinew.² The average length of the feathers on five specimens is $7\frac{1}{2}$ inches; the average distance from the end of the feathering to the butt is $4\frac{1}{2}$ inches. The feathers themselves were prepared for attachment as follows: the end of the quill was cut off and into its hollow body there was introduced a tight fitting plug, 1 inch to $1\frac{1}{2}$ inches long, either of wood or of the sharp, hard tip of a yucca leaf. The end of the quill was further solidified by wrapping it about with sinew. Both these features are illustrated in b.³ Heavy flat seizing of sinew secures the thus prepared lower end of the feather to the shaft; the light tip end has no extra strengthening and is merely bound to the shaft with a few turns of thin sinew. The purpose of this careful plugging and binding of the quill was undoubtedly to render it so firm and solid that it could be tightly bound to the shaft at exactly the correct angle; an unplugged quill would have been crushed by the ligatures, and the feather

¹ Though not uncommon in cliff-dwellings, we have found no such implement among Basket-maker remains. The Cliff-dweller wrenches are made of mountain-sheep horn, are 9 to 10 inches long, and have a hole, or a series of holes of different sizes, in one end; through these the shaft was drawn and then straightened by leverage on the other end (see Kidder-Guernsey, 1919, plate 46, a, e). See also Hough, 1919, plate 46, figure 4.

² We are now able to rectify an error in our previous report. In our restoration of the feathering of atlatl darts there given (figure 89) we were misled by the presence of some extra seizing bands not really connected with the feathering, and postulated a triple attachment like that on lower Yukon shafts. This is incorrect.

³ Although we have not seen the specimens, we think it likely that the loose ends of cords bound under the seizing of the feathers on darts described by Pepper (1905, p. 121) represent the remains of feather-butt reinforcements similar to those just described.



WHITE DOG CAVE

a, b, d, Lower portion of darts showing method of feathering; c, Point of dart; e, Upper portion of dart showing bunt-head; h, Upper portion of shaft showing socket for foreshaft; f, g, i, Foreshafts with chipped stone points; j, Foreshaft in position, and upper portion of shaft. (About $\frac{1}{2}$.)

would not have held rigidly to its intended position. The arrangement just described is, as far as we know, unique in shaft feathering, but is found in the feather hair ornaments of the Mohave (P. M. catalogue number 10091).

So little of the pile of the feathers has resisted decay and the ravages of insects that it is impossible to identify the species of birds from which they were obtained. Plumes of corresponding length and weight, tied into bundles and perhaps intended for the winging of darts, were found in Cave 1, Kinboko, in 1915 (Kidder-Guernsey 1919, plate 81; a, b); these belonged to Hutchin's (?) wild goose (*Branta canadensis hutchinsi*) and the western red-tailed hawk (*Buteo borealis calurus*).

A non-functional feature of the main-shafts remains to be described, namely, decoration. All the darts are painted or stained on the shaftment under the feathering, and also for a short distance back from the socket end; some, we judge from fragments, were colored their entire length. The most elaborately decorated shaftment (plate 34, a) is painted black with a spiral line of red; a second (d) was painted black over a temporary wrapping, which when removed left a spiral ornament in the light natural color of the wood. Another, on which the paint shows but faintly, seems to bear four broad longitudinal lines separated from each other by narrow stripes of natural surface. Most of the socket ends were painted black as shown in h, two, however, are red; and one socket end 25 inches long is stained black for 15 inches, thence to the break it is light red.

In the collection are a few broken main-shafts that have been put to secondary uses. The flint-flaker shown in figure 15, b, c, is mounted on such a fragment; another piece, from the butt-end of a dart, was whittled to a sharp point and served as a skewer-like pin for fastening together the wrappings of a mummy.

Foreshafts, complete with points, are represented by five perfect specimens from White Dog Cave. All of these are tapered at one end to fit into the socket of the spear shaft, and are notched at the other to provide a seat for the stone tip. The one shown in i, plate 34, formed part of a bundle resting in the lap of a mummy in Cist 31; it is the largest in the collection.¹ It is made from a peeled stick unworked except at the ends. The point is of red

¹ See table of measurements at end of description.

jasper and is secured to the stick by a seizing of heavy sinew. The one illustrated in f, found near the right hand of mummy 2, Cist 27, is slightly tapered at the notched end. The red jasper point is firmly wedged in the notch; the sinew bindings were in place when the specimen was found, but crumbled away on exposure to the air. Specimens g, and j, lay at the foot of mummy 1, Cist 24. The latter is flattened on either side at the notched end; its head is of yellow jasper and is secured to the shaft by a neat seizing of fine flat sinew applied very tightly. The body of the shaft is painted with a thin grey wash; at the notched end on either side are daubs of thick dark red paint put on over the wrappings and also discoloring the base of the chipped point. The head of g, is worked from a thin spall of dark flint, the original surface of the flake showing on one side. It is fastened to the shaft with flat sinew. The shaft itself is colored with dark red paint which ends where the taper begins, showing that it was tinted after it had been inserted in the main-shaft of the dart.

MEASUREMENTS OF FORESHAFTS IN INCHES

	A	B	C	D
Total length	$6\frac{3}{4}$	$5\frac{5}{8}$	6	$5\frac{3}{8}$
Length of shaft	$4\frac{3}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{1}{8}$
Diameter of shaft	$\frac{1}{2}$	$\frac{7}{16}$	$\frac{3}{8}$	$\frac{3}{8}$
Length of head	$2\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{5}{8}$	$1\frac{1}{2}$
Width of head at base	1	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{3}{4}$

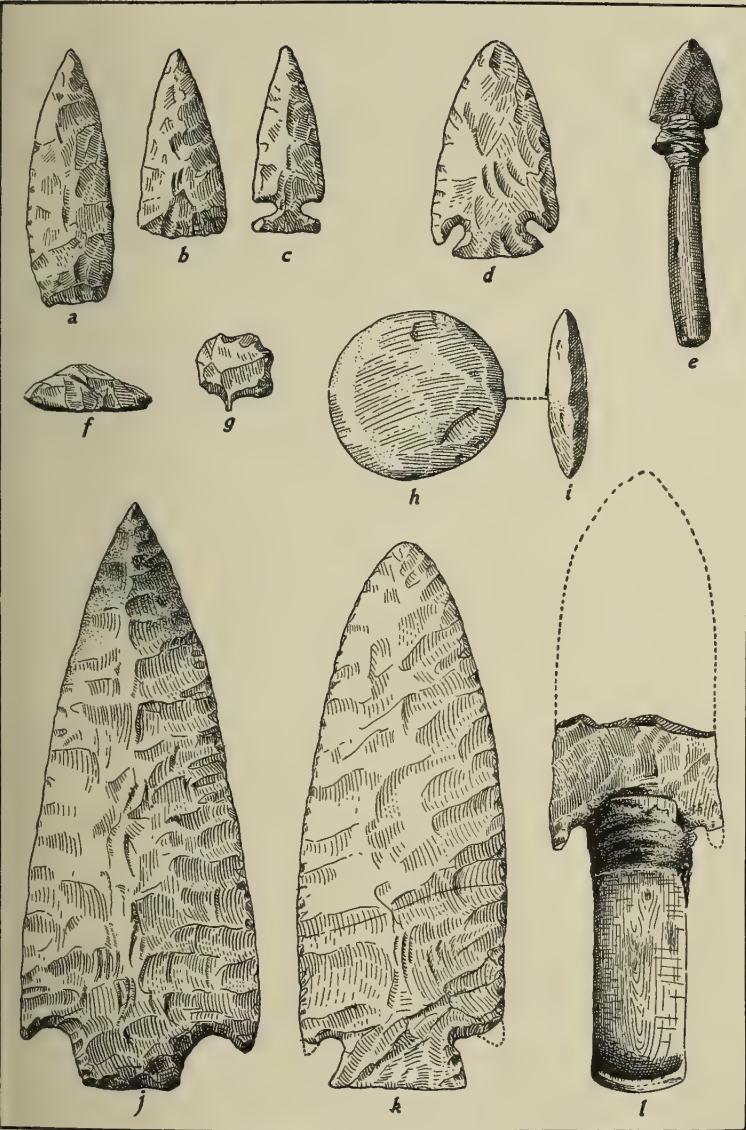
Comparing these with the dimensions of foreshafts from south-eastern Utah given by Pepper (1905, p. 127), it will be seen that the latter average considerably larger.

On plate 34, e, is shown a wooden bunt head tightly wedged into the socket of the main-shaft, beyond the end of which it protrudes for $1\frac{1}{2}$ inches. The rounded end is $\frac{3}{4}$ of an inch in diameter. It is roughly finished and is much like a specimen figured in our first report, which we thought might possibly be a bunt head for an atlatl dart.¹

Pepper,² illustrates several foreshafts with bunt heads of bone fitted down over them. Nothing of this sort is in the collection, but there is a main-shaft, c, whose distal end, instead of being provided with the usual socket, is brought to a plain tapering point.

¹ Kidder-Guernsey, 1919, figure 92 and p. 185.

² 1905, plate III.



a, b, Unfinished foreshaft points; c, Foreshaft point; d, Chipped knife blade; e, Hafted pipe-drill; f, Chipped atlatl stone; g, Chipped flint graver; h, i, Unfinished flint disc; j, k, Chipped knife blades; l, Flint knife (blade broken). a, f, h, i, j, k, l, White Dog Cave; b, c, d, g, Burial cave, Sayodneechee Canyon; e, Cave 6. (About $\frac{1}{2}$.)

It is possible that a bone head was slipped on over this, and the foreshaft dispensed with.

Dart Points.¹ All the chipped atlatl dart heads which were found attached to foreshafts were of the tanged variety. From a skeleton in Sayodneedchee Cave (1914), however, and in a little skin sack from Cist 6, White Dog Cave, were recovered a number of points similar in size and shape to the tanged specimens but with unnotched bases (plate 35, a, b). We believe these are dart heads completed up to the final step of flaking out the deep notches on the lower sides, a step deferred until just before mounting them in the foreshafts, because of the danger in an unmounted condition of breakage of the long and delicate flanges. Almost all our finished points are notched at right angles to their long axes, the notches having a depth equal to about one-third of the total width of the base. The notches of the large chipped knives, on the other hand, instead of being set at right angles to the long axes of the specimens, run in at an acute angle (compare the specimens illustrated in the two plates, 34 and 35).

Atlatl Stones. On plate 35, f, is illustrated a chipped object thought to have been originally fastened to the back of the atlatl shown in f, plate 33, which was found in the same cist with it (Cist 24, White Dog Cave). The material is translucent quartz; in shape it resembles a diminutive "turtle-back" with one flat surface. On the upper, or convex, side are faint marks that appear to have been made by wrappings.

Four small loaf-shaped stones were taken from the bottom of Cist 27. Though somewhat smaller than those fastened to atlatls b and d, plate 33, they are of about the same shape and were without much doubt atlatl stones. Each of them has one side flattened to fit snugly against the atlatl shaft. Three are made of a green stone somewhat the color of, but less hard than, jade; the surface of one is polished, the other two are roughened as if by some chemical action, but retain traces of an original polish. The fourth stone (plate 17, f, g) has rather more pointed ends and differs further from the others in having a deep concavity cut in the under side; it is made from an unidentified fossil and the surface is unpolished.

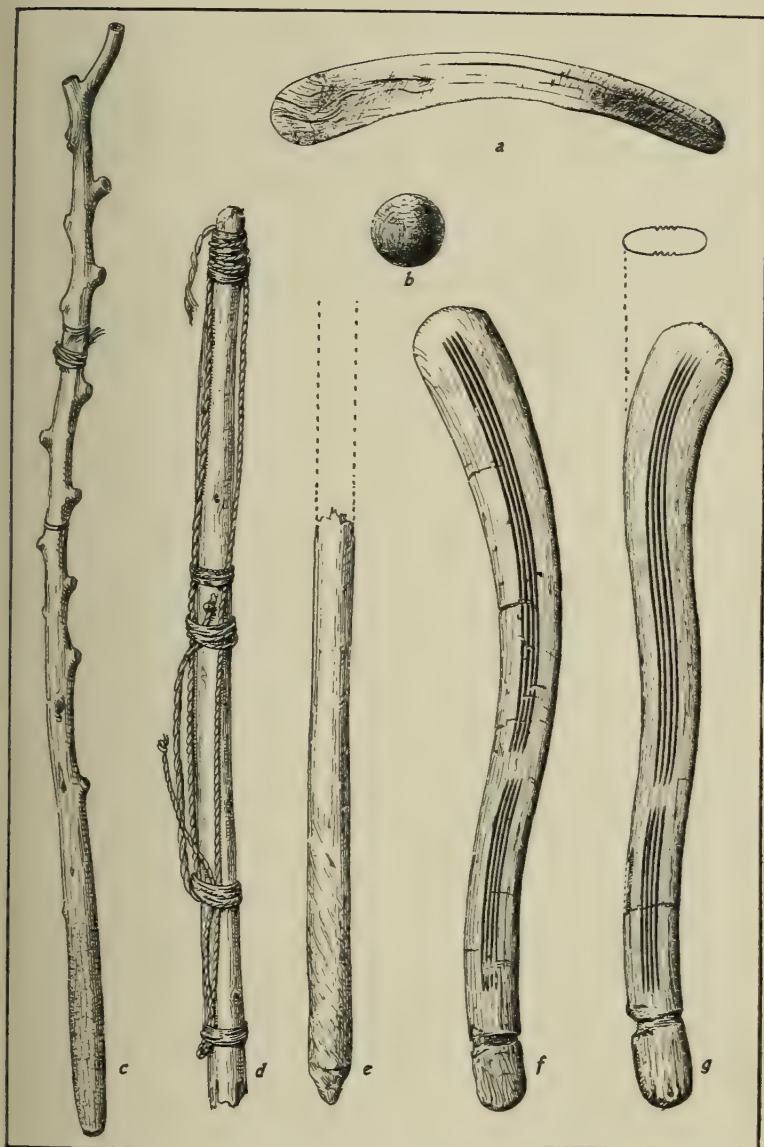
¹ These and the following specimens (atlatl stones) are treated here, rather than under their proper place among the stone objects, because they are really integral parts of the atlatl.

Another specimen is perhaps an unfinished atlatl stone; parts of its surface show chipping, others grinding. The material is the same as in the group of three described above.

Grooved Clubs. On plate 36, f, g, are shown two of these objects. The collection contains four complete specimens and one fragment. The former are from burial cists in White Dog Cave, and the fragment is from a looted and partly burned-out burial cist in Cave 6. The best preserved of these is one of a pair found with the mummy of an adult male in Cist 27. It is $20\frac{1}{2}$ inches in length, 2 inches wide at the broad end, and tapers to $1\frac{1}{2}$ inches in width at the small end; the average thickness is $\frac{5}{8}$ of an inch. The warping of the stick may be partly accidental as it will be noted that the two specimens figured are not bent in the same direction. The edges and broad surfaces are rounded (see cross-section of the one illustrated in g). On each side are four deep parallel longitudinal grooves 17 inches long, with a break at one point as shown in the drawing. These grooves are neatly made, evenly spaced, V-shaped cuts. Two inches from the small end the club is ringed by a deep groove, set at a slight angle and widened at one edge to a broad curved notch; in the groove are traces of cord or sinew wrapping. A cement-like substance, thickest about the edge of the notch, still adheres to one side of the stick, and seems to have been put on over the wrappings. It is possible that the groove and notch may represent a seat for a wrist cord. There are two other much shallower encircling grooves, one 4 inches, the other $5\frac{1}{4}$ inches from the small end; in these also are marks of wrappings. All surfaces of the club show careful finish, but no traces of paint, the only color being a thin red line in one of the grooves which is probably a print from a wrapping cord. The edges and ends of the stick are not bruised or battered. Because of age and partial decay the club now weighs but $2\frac{1}{2}$ ounces, but an undecayed fragment from Cave 6 shows the original wood to have been dense and heavy.

The foregoing description will answer for all the clubs in the collection, as they show little individual variation. While we can assign no specific use to these objects, we do not think they are rabbit-sticks such as those used among the Pueblo tribes.¹ Most of the latter differ from these in some details, particularly the

¹ Mr. C. C. Willoughby has suggested that they may have been used to ward off spears after the manner in which the natives of one of the Solomon Islands use an odd-shaped club for fending off spears, and also as a weapon of defense.



a, Wooden implement; b, Wooden gaming ball; c, Ceremonial stick; d, e, Opposite ends of wooden device; f, g, Grooved clubs accompanying atlatls. All from White Dog Cave except a, which is from Cave 14. (b, about $\frac{1}{2}$; a, c-g, about $\frac{1}{5}$.)

familiar type used by the Hopi, which in addition to having a hand grip cut at one end, is as a rule decorated by a painting with a prescribed design, one element of which is a pair of black markings symbolizing rabbit ears or rabbit feet. An ungrooved rabbit-stick, 6 inches longer than our grooved clubs but somewhat resembling them in shape, is in the Peabody Museum. It was collected by Dr. Edward Palmer in 1875 from the Diegueño Indians and is catalogued as a "boomerang." Clubs identical with our specimens were found in a pit-shrine near Laguna, New Mexico, by Mrs. Parsons,¹ and Hough figures one from a cave near Lava, New Mexico.² In the Peabody Museum are fragments of two grooved clubs from Yucatan which differ from ours only in that the broad surfaces and the edges are flat instead of rounded, and that there are a greater number of the parallel grooves. The sculptures of Chichen Itza frequently depict these clubs, usually in the hands of warriors who also carry atlatls and atlatl spears. One is figured most realistically on the sculptured top of an altar in the outer chamber or vestibule of the Temple of the Tigers, where it is shown in the left hand of a warrior, who bears as well an atlatl and sheaf of spears.

In company with all the grooved clubs noted either atlatls or some adjunct of the atlatl were found. The significance of this is two-fold; first, that it aids in establishing the identity of the Laguna pit-shrine and Lava cave specimens as Basket-maker; second, that it shows these clubs to be a distinct type used by a people who also used the atlatl. That the Laguna clubs were found with other offerings most of which were feather sticks of relatively recent make does not, to our minds, affect the question of their antiquity; the probable explanation of their presence in the shrine being that they were found in a Basket-maker cave by some Pueblo Indian who regarded them as appropriate offerings for the same reason that ancient arrow points are still prized by the Pueblos as fetishes. This seems all the more likely as the Zuñi are said by Mr. Cushing to have recovered baskets from prehistoric deposits.³

Planting Sticks. In plate 37 is a series of planting sticks: numbers a, c, d, and g were found in Cist 24, White Dog Cave; e and f are from Cave 9.

The one shown in g, we regard as a type specimen of Basket-maker planting stick; it is 45 inches in length and is made from a

¹ Parsons, 1918, figures 36, 38, 39.

² Hough, 1914, p. 19, figure 21.

³ Ibid., 1919, p. 267.

root of some hardwood tree, possibly oak. The whole surface has been smoothed by grinding, but very little altered in shape. The smoothing process has removed all bark except that in the deep depressions such as occur in roots. One end has been worked down to a thin blade having a rounded point and one sharp edge. The blade is 2 inches in width and begins 17 inches from the end of the stick. It has a smooth, almost polished surface. The crook at the proximal end is natural, but it gives the implement a nice balance when held in position for use. This specimen shows long service.

The sticks represented in e, f, differ but little from the one just described. Both are made from roots; f, is $42\frac{1}{2}$ inches in length and has a very thin blade with one sharp edge; e, is 32 inches in length with a blade $2\frac{3}{8}$ inches wide, sharp on the end and curved edge.

The Cliff-dweller planting sticks which correspond to these in form are much lighter in weight with thinner blades, and nearly straight, carefully shaped handles that normally terminate in round knobs.¹

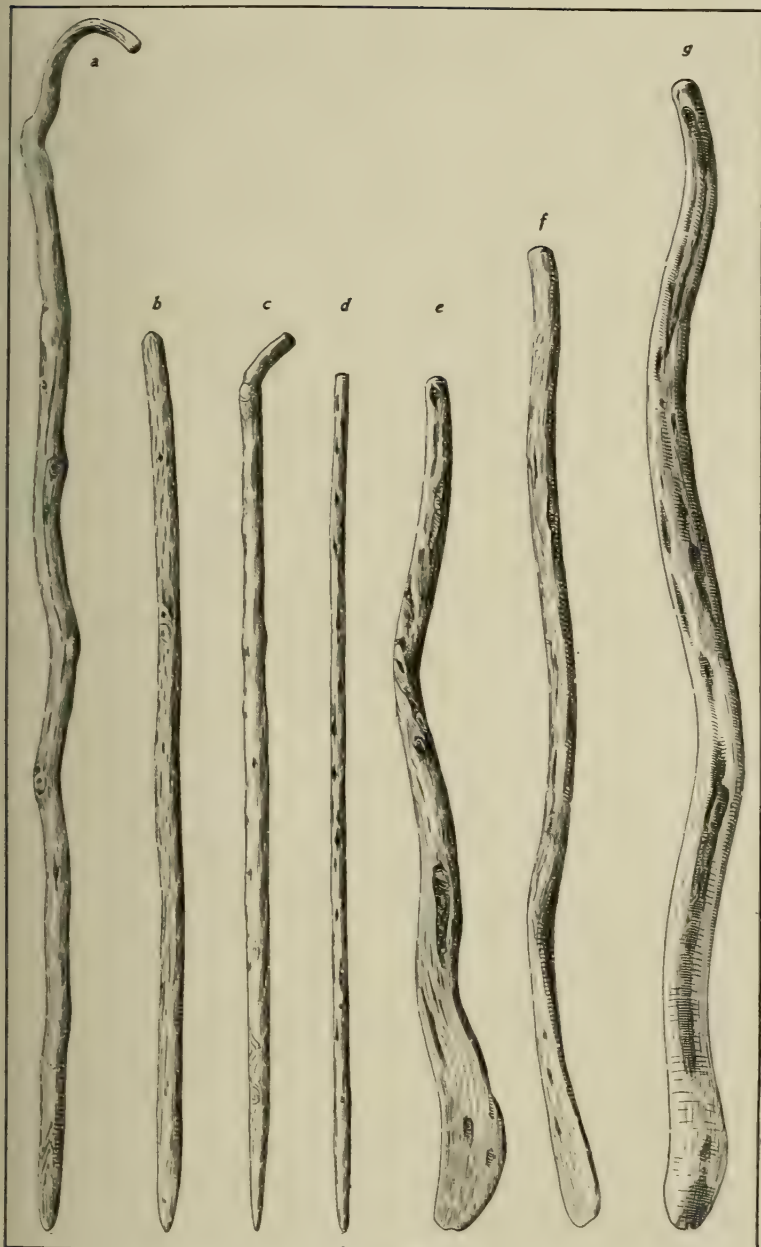
The one figured in a, found with mummy 1 in Cist 24, is of a different type, having a plain flattened point instead of a thin-edged blade; it is 49 inches in length and averages $\frac{7}{8}$ of an inch in diameter. One end is worked down to a flat point, the other end has an artificial crook. It is made from a peeled limb of some hard wood. Knots are rubbed down and smoothed. This stick is dark in color and polished for its entire length by handling and wear.

The specimen shown in b, from Cist 6, White Dog Cave, is made from a heavy greasewood stick; it has a flattened point like the one just described. Simple sticks of this nature are also common in cliff-dwellings, and are used today by the Navajo.

The implement, c, is made from a rather light wood and has a neatly tapered point; the crook at the small end is partly natural; d is 32 inches long and is made of a slender greasewood stick; it has a long finely tapering point. The entire length of the implement has been smoothed and rounded. The point is slightly polished.

Scoop-like Objects. Wooden objects similar to those represented on plate 38, g, h, i, were found so regularly in Basket-maker

¹ See Kidder-Guernsey, 1919, plate 47, d, e; the stick shown in plate 47, c, we now think is probably Basket-maker. It was found with a disturbed burial in a small cave in Sagi Canyon.



Planting sticks. All from White Dog Cave with the exception of e and f, which are from Cave 7. (About 1/7.)

caves that we came to regard their discovery in the preliminary examination of a site as an indication that other traces of Basket-maker occupancy would be found. For this reason they are given a more detailed description than their commonplace appearance might seem to warrant. All of them have very much the same general form as those illustrated; this seems due to selection rather than to shaping as they are simply wooden slabs from small logs, the outer or convex surface natural, the inner side and ends usually charred by fire. From this and their appearance as a whole, we judge that they were merely unconsumed pieces of firewood, selected, as before stated, on account of their shape. A few, however, show no burning, being shells of wood rifted from the outer part of a timber, then ground at the ends to the required length.

One unvarying feature of these objects is their worn and rounded edges; we once used a similar piece of wood to scrape the loose sand from a cist and found that the edges soon became worn in the same way; for this reason we are inclined to think they were employed principally for digging cists. They were, no doubt, found useful for other purposes, as one in the collection has a quantity of caked yellow pigment adhering to its concave side. Apparently it had been used as a palette. Such slabs might also have served as rude food trays, and possibly for beating and shredding grass, a guess that we hazarded in our first report. Still another possible function for these objects might have been transferring hot stones from the fire to cooking baskets, in which case they may have been used in pairs. Though all those found were not saved the collection contains nineteen pieces ranging in size from $5\frac{1}{2}$ inches long and 3 inches wide to $18\frac{1}{2}$ inches long and 6 inches wide, the average dimensions being 7 inches long and 4 wide, a convenient size to use in the hand.

Hough figures "a shell of wood" from Tularosa cave which resembles the implements just described;¹ while another from the Mesa Verde apparently identical with ours is figured by Morris.²

Curved Wooden Tools. Our two specimens are so closely similar to each other that it is probable they represent a definite type. The better preserved example (plate 36, a) is a piece of very hard, close-grained wood, 12 inches long. Its pronounced curve is apparently natural, but all its surfaces have been worked down by

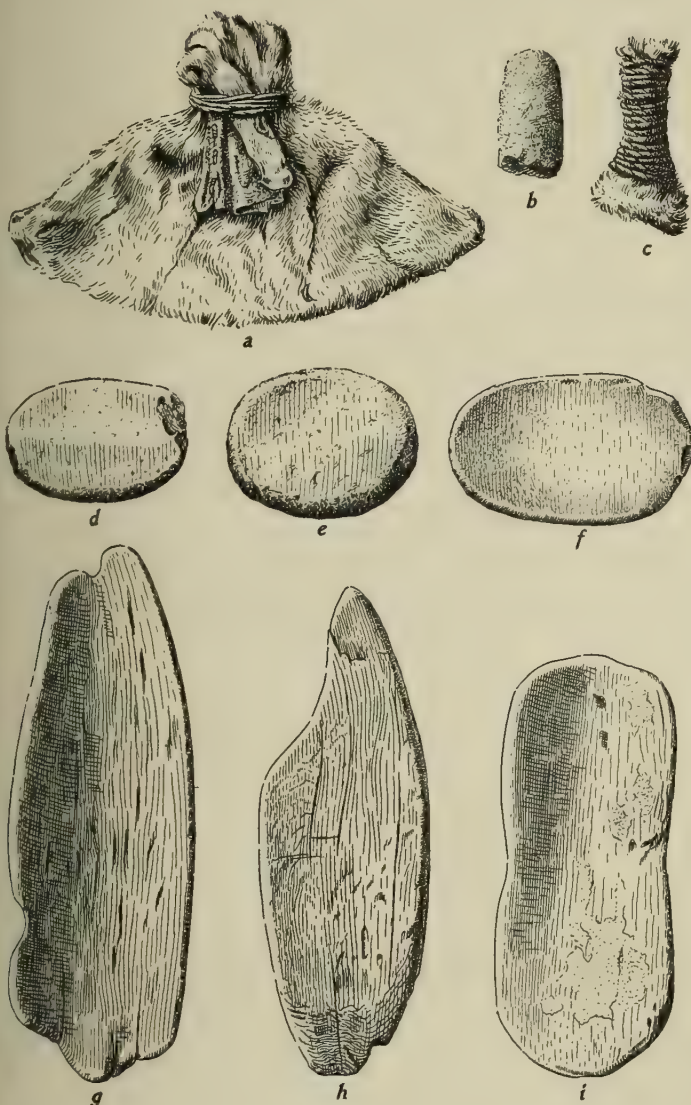
¹ Hough, 1914, plate 14, figure 2.

² Morris, 1919, a; plate 44, e.

whittling or scraping. One end is almost round, the other much thinner. The middle part of the concave side is worn to a slim rounded edge and is highly polished by long use. The two ends are stained dark by much handling. The object was obviously held by the ends and worked toward the body like a modern draw-knife. The unscratched condition and high polish of the concave edge shows that it must have been used on some non-abrasive substance. Its curve fits the thigh so well that we have thought the implement might have been employed in some way for dressing or suppling hides held over the knee.

The second specimen, though a trifle longer, is of the same shape and bears the same polish on the inner edge.

Other Objects of Wood. On plate 41, a, is illustrated a pair of slim worked twigs, $7\frac{1}{2}$ inches long and $\frac{3}{16}$ of an inch in diameter. The two are held together by a string tied in little grooves that encircle their lower ends; this is evidently a permanent attachment but it is loose enough to allow the two sticks to be spread apart. An adjustable tie was evidently used at the upper end, for there only one twig is grooved and the other has a small hole drilled through it. A string is made fast to the grooved stick; its loose end was undoubtedly passed through the hole, pulled tight and made fast when it was desired to close the pair together and hold them in place. A number of similar objects are in the Grand Gulch collection in the American Museum, New York (H-13180 and H-13267); these sticks are also tied permanently together at their lower ends, and have a loose-ended string set in a groove at the upper end of one of them. The other stick, in each of the New York pairs, has a little string loop instead of the drilled eye of the example here illustrated. All these specimens were evidently designed to be clamped over and made fast about objects 6 or 7 inches wide and not over $\frac{1}{4}$ of an inch thick. As to what such objects might have been we are entirely ignorant. A wooden awl about 6 inches long, made from a peeled greasewood stick, was found; the butt is cut off square and the other end is whittled to a sharp point. For a variety of other specimens made wholly or in part of wood, see under "Ceremonial Objects."



a, b, c, Skin bag and contents; d, e, f, Manos or grinding stones; g, h, i, Wooden scoops.
 a, b, c, Cave 14; d-i, White Dog Cave. (About $\frac{1}{2}$.)

OBJECTS OF STONE

Manos. These are intimately related to the domestic life of corn-growing Indians, and in a measure furnish an index to their progress as agriculturists. The manos of the more highly developed tribes, such as the Pueblos, show a tendency towards specialized forms; while those used by people of less firmly established corn-eating habits are as a rule stones of convenient shape with little or no alteration of the original form other than that due to wear. Basket-maker manos belong to the latter class. Three typical examples from White Dog Cave are reproduced in plate 38, d, e, f.

The latter is $5\frac{3}{4}$ inches long, $3\frac{1}{2}$ inches wide, and $1\frac{1}{4}$ inches thick. It is made from a thin slab of indurated sandstone the edges roughly worked down to give the implement an oval shape. Only one surface shows use, this is ground nearly flat. The one figured in d, is $3\frac{3}{4}$ inches long, $2\frac{3}{4}$ inches wide and $1\frac{3}{4}$ inches thick; it is a hard lava-like stone of natural shape. One side is much worn and has a convex surface; a small area of the top also shows signs of use. That shown in e, is slightly larger than the last and of the same material. The form shows slight modification and both sides are about equally worn.

In addition to the above specimens, there is in the collection half a mano of soft sandstone with edges pecked and ground to give it an oval shape. Both sides are much worn; one shows traces of a dark red, the other of a yellow color, presumably evidences of secondary use as a paint grinder. Another stone of about the same size but which is probably not a mano, is a rounded river boulder $4\frac{1}{2}$ inches long and $2\frac{1}{2}$ inches thick. A portion of either side bears a high polish quite different from the rough surface produced by grinding on a metate. This polish is obviously the result of long rubbing on a non-abrasive surface; work on hides or use in hulling seeds in a basket may be suggested.

Metate. A single broken specimen was found. Like the manos it is of a crude and unspecialized type, being merely a flat slab unmodified except for a hollow on one side, the width of which is the same as the length of the manos.

Chipped Knife Blades. One of these specimens (plate 35, j) was found at the right hand of mummy 2, Cist 27, White Dog Cave.

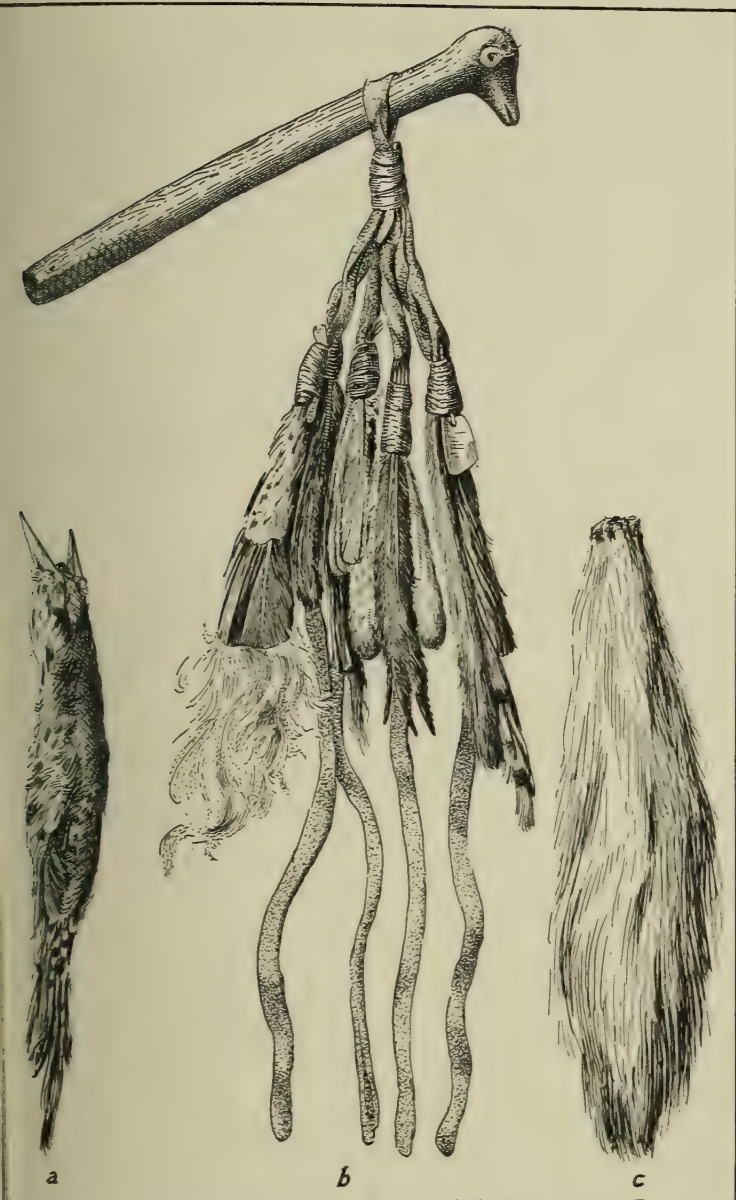
Its length is $6\frac{7}{8}$ inches, its greatest width is $2\frac{7}{8}$ inches, the average thickness is $\frac{1}{4}$ of an inch. The material is a mottled yellow flint. The point for $1\frac{1}{2}$ inches is a dark red which seems due to staining rather than being the natural color of the stone. It was reduced to an even thinness by the chipping off at regular intervals of long broad flakes, at so obtuse an angle that no central ridge is left, the face of the blade being slightly convex instead of angular. The cutting edge is keen, the result of fine secondary chipping. The stem is tapered to a wedge-shaped base.

The blade shown in k was found with mummy 3, Cist 22. It had been broken in two pieces before burial; the halves lay at a little distance from each other and one of them was discolored by some agency to which the other was not exposed. This blade measures $6\frac{1}{2}$ inches in length, $2\frac{1}{2}$ inches in width, and averages slightly under $\frac{1}{4}$ of an inch in thickness. The material is chalcedony. It differs but little from the first specimen, except that the end is rounded and shows signs of an attempt to grind away a slight protuberance that had resisted the original chipping. On the base of the blade are traces of the gum that once served to cement it to its haft. The latter was also found in the cist; and although it is badly rotted and shrunken, its notch still fits the blade. In shape it is a duplicate of the haft next to be described.

The workmanship of these two knives compares very favorably with that of similar implements from other parts of North America. In shape and general appearance they most closely resemble the large chipped knives of Mexico and Central America.

Hafted Knife. The specimen shown in plate 35, l, is from Cist 6, White Dog Cave. The blade, part of which is unfortunately missing, was probably once $4\frac{1}{2}$ to 5 inches long; it is 2 inches wide at the base and has a thickness of $\frac{1}{4}$ inch. The material is a close-grained white stone. The chipping of the portion that remains is rather coarse, though the notches and barbs show skillful flaking.

The wooden handle measures $3\frac{1}{4}$ inches in length, a fraction over 1 inch in width, and has an average thickness of $\frac{3}{8}$ of an inch. The lower end thickens considerably to allow for a notch $\frac{3}{4}$ of an inch deep into which the blade is set and there held in place with cement-like gum reinforced by a small wooden wedge and wrappings of pitch-smear string. The handle is well-preserved and shows careful finish; it appears to have been made from a section of a small



WHITE DOG CAVE

Ceremonial objects: a, Stuffed bird skin; b, Wand; c, Deer tail. (About 3/5.)

limb worked down to shape by cutting away two surfaces; both the wide sides thus produced are slightly convex, while the edges are nearly flat. At the butt the handle curves and terminates in a neatly finished end, the peculiar form of which is duplicated in two other less well-preserved specimens; one of them is the handle of the large chipped blade, k, previously described. This type of butt may represent an individual whim, or it may perhaps prove to be a characteristic of Basket-maker hafts. There are a number of stone knives with plain handles from this general region in the collections of various museums; some or all of these may be Basket-maker, but unfortunately the data accompanying them leave doubt as to their exact origin. What are, however, surely Cliff-dweller hafts from Aztec, New Mexico, are described and figured by Morris,¹ and one from the Mesa Verde is illustrated by Nordenskiöld.² Hoffman figures two modern Ute knives with plain handles.³

Pipe Drill. The chipped point shown in plate 35, e, is apparently an old darthead remounted in its present handle. It is of very hard, lustrous flint, $1\frac{5}{16}$ inches long, and $\frac{3}{16}$ of an inch in breadth at the base. Both edges are much worn down and beveled by long-continued boring, the plane of the bevels indicating clockwise rotation. The handle is a stick $2\frac{1}{4}$ inches long, $\frac{3}{8}$ of an inch thick, having one end rounded, and the other notched to provide a seat for the chipped point, which is held in place by a seizing of fiber string.

The wear on the point indicates clearly that this specimen was used as a drill, and the nature of the haft confirms this. Held in position for boring, the haft is found to be just the right length to bear against the palm of the hand at the base of the index finger; in this position the drill can be easily turned by the index and third fingers and the thumb, while pressure can be applied to the butt by the palm. The chipped point exactly fits the bores of the Basket-maker stub pipes.

No pipes were found in 1916-1917, but type examples are shown in figure 94, a, b, c, of our previous report.

Graver. A tiny stone tool, evidently designed for scratching fine lines on wood or bone, is illustrated in plate 35, g. It is an irregularly shaped jasper flake, less than an inch in diameter, and $\frac{3}{16}$ of an inch thick; the top is convex; the lower side is flat at one

¹ 1919, p. 33 and figures 17, 18.

² 1893, p. 97, figure 59.

³ 1896, figures 52, 53.

place where a small and very sharp point has been carefully chipped out. Such an implement as this must have been used to incise the clean-cut parallel lines seen on the curved wooden clubs figured on plate 36, f, g.

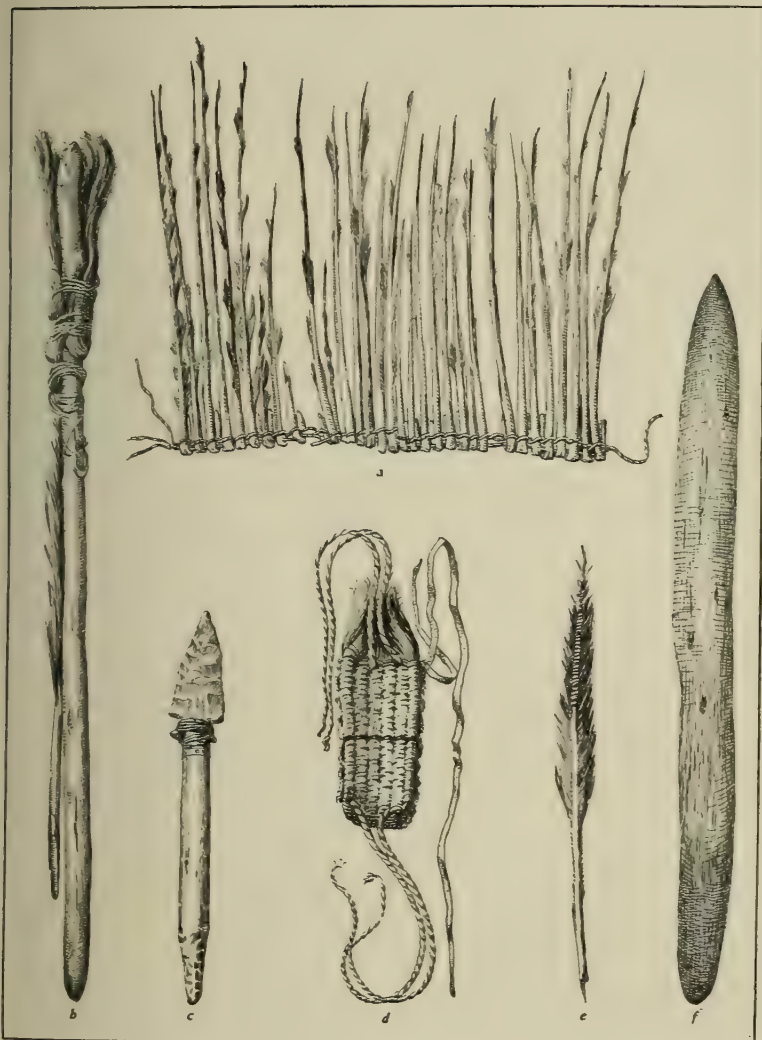
Flaking Tool. This implement (figure 15) from plundered Cist 6, White Dog Cave, is included here because of its intimate connection with stone chipping. So far as we know it is the only complete example of a prehistoric flaker of its type that has yet been found. It consists of an antler or very hard bone point mounted on a wooden shaft in the manner indicated in the drawing, which also shows more clearly than a description the shape of the point itself. The length of the latter is $3\frac{1}{4}$ inches, of which $\frac{5}{16}$ of an inch projects beyond the end of the shaft; the width appears to be uniformly $\frac{1}{4}$ of an inch. The projecting portion tapers to $\frac{1}{8}$ of an inch at the extreme end. The shaft is a piece of an old atlatl spear shaft 35 inches long. The bone point is bound to the smaller end of this by seizings of skin overwrapped with sinew. The larger end is worked to a rounded point, for the purpose, perhaps, of allowing it to be easily thrust into the sand to hold it upright while the workman was using other tools. In the middle are a number of turns of a wide thong of skin wound spirally about the shaft and running towards the working end. These are applied in two layers, one above the other; at the distal end they are held in place by a binding of sinew and there are signs that they once extended farther down the shaft than they do at present. These wrappings were probably cut from hide with the hair on it, although the fur has now almost entirely disappeared; their purpose will be discussed later.

There is no doubt that this implement was used as a stone-flaker. Pope figures a Yurok bone pointed arrow-flaker with a shaft $17\frac{3}{8}$ inches long, which is very similar to this specimen.¹ Rau illustrates another from Nevada which he describes as a slender blunt point of horn bound with cotton cord to a wooden handle about the thickness of an arrow shaft. According to the drawing the length of the latter is $29\frac{1}{2}$ inches.² Cushing gives a sketch of an arrowmaker using a long-hafted flaker, but provides no information as to the data on which the drawing is based, though he briefly describes the way the implement is used.³ The following

¹ 1918, plate 27.

² 1876, p. 96, and figure 340.

³ 1895, figure 6.



WHITE DOG CAVE

Objects forming bundle from lap of mummy (plate 7, b), Cist 31. (About 4.)

is Schumacher's description of the Klamath method of flaking: "The tool is worked with the right hand, while the lower part of the handle, usually ornamented, is held between the arm and the body so as to guide the instrument with a steady hand."¹ The foregoing makes clear the advantage of the long shaft, but does not point out the fact that the weight of the body can, by means of it, be brought to assist the pressure of the hand.

We can find no reference to padding of that part of the shaft that is held between the arm and body; such was undoubtedly

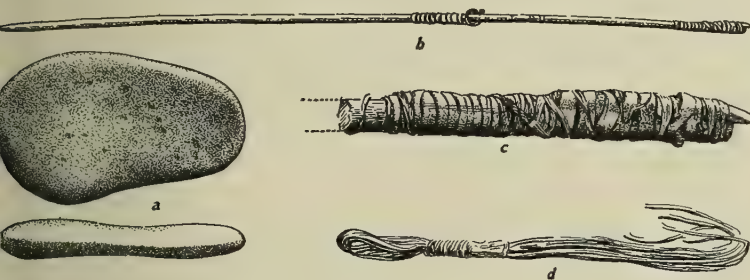


FIGURE 15

a, Flaking stone; b, Arrow-flaker of antler in wooden haft, much reduced in size; c, End of arrow-flaker; d, Package of sinew cord. All from White Dog Cave. (About $\frac{1}{2}$, with the exception of b.)

the purpose of the central hide wrappings on our specimen. A soft furry padding of this sort must have contributed greatly to the comfort of the user, particularly if his arm and body were not protected by clothing; and it probably helped also to secure a firmer grip than would be offered by the bare shaft.

Flaking Stone. The specimen shown in a, figure 15, is a small flat unworked stone, oval in outline, $3\frac{1}{4}$ inches long, $2\frac{1}{2}$ inches wide and $\frac{1}{2}$ inch thick. It is much like certain stones obtained in the Museum's explorations of ancient burial places in Erie County, New York, which were invariably accompanied by bone flaking implements as well as finished and unfinished chipped points and knives. The Museum collection also contains similar stones from Madisonville, Ohio,² and eastern Massachusetts. Mr. Willoughby has identified these stones as forming part of the flint worker's equipment. The stones from New York, Ohio, and Massachusetts are marked with scorings which are not present on this specimen;

¹ Quoted in Holmes, 1919, p. 312.

² See Hooton and Willoughby, 1920, plate 6, 1, m.

our tentative identification of this as a flaking stone is strengthened by the fact that it was found among the partly rifled contents of Cist 6 which also held the hafted flaking tool described above, as well as a small skin bag containing two nearly finished points, a number of flakes of flint and various colored jasper, a combination of objects exactly duplicating those found in the New York graves.

OBJECTS OF CLAY, BONE, ETC.

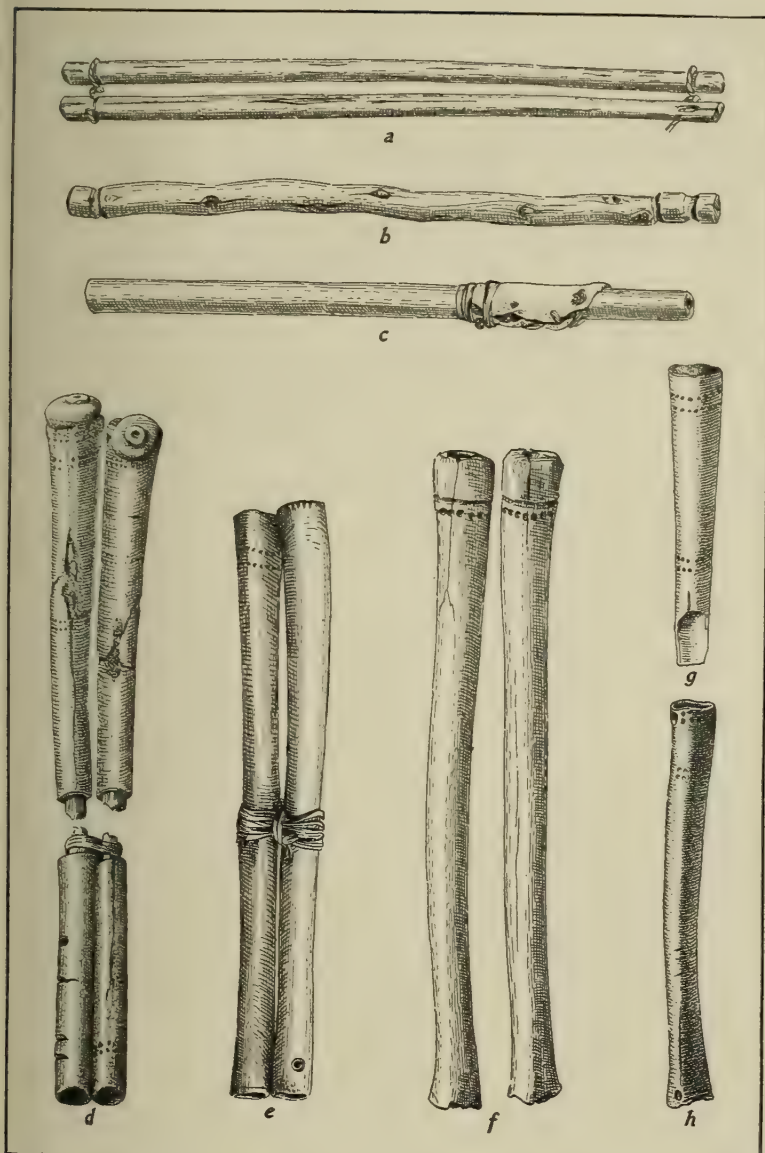
Pottery. No specimens of true pottery, either vessel or sherd, have yet been found by us under circumstances indicating that it was a Basket-maker product. All but one of the several jars discovered came from the surface sand overlying the Basket-maker deposits; they are of common cliff-house ware, and were undoubtedly cached in the caves at a comparatively late date. The exception is a pot found in Sunflower Cave in 1915, lying below a cliff-house floor. This was figured in our previous report and referred to as possibly of Basket-maker origin.¹ It is of plain black ware, uncorrugated; in shape it is almost spherical. No further evidence that the Basket-makers produced vessels of this type has since come to light, and we are inclined to consider it early Puebloan.

The only specimen that even remotely resembles pottery was found in Cave 6. It is a fragment from the rim of a shallow dish-like receptacle nearly $\frac{1}{2}$ inch thick, made of unburned clay heavily tempered with shreds of cedar bark. It was molded in a shallow basket, the print of which is plainly visible in the outer surface of the sherd (plate 25, a). The inner side is smoothed off, but has an irregular, wavy surface as if it had been done by the fingers. We do not know whether this specimen is merely a fragment of a clay lining put in a basket to render it watertight or fireproof,² or whether it really represents an early attempt at pottery making.

Bone Objects. Objects of this material described under other heads are: beads, flaker, decorated tubes, rattle handles, plain tubes, and whistles. This practically completes the list of specimens made of bone, the only others being a few awls (plate 42, e-h), and a pair of unworked cannon bones of the deer, found

¹ Kidder-Guernsey, 1919, plate 59, a, and p. 144.

² Cushing (1886, p. 484) describes a Havasupai roasting basket lined with clay. The present object may have been made for a like purpose, but it was certainly never so used, as bits of the cedar-bark tempering which protrude from the inner surface are not even scorched.



a, b, c, Objects made from short sections of sticks; d, e, f, Paired bone tubes; g, h, Bone tubes. All from White Dog Cave except f, which is from Sunflower Cave. (About $\frac{1}{2}$.)

carefully wrapped up in a bunch of shredded cedar bark at the feet of mummy 1, Cist 24, White Dog Cave. These were probably selected and laid aside to be fashioned later into awls. No bone scrapers occur.

Dressed Skin. The skins of animals were much used: some as rawhide, some dried, and others dressed with or without the hair. Specimens of the latter were very finely dressed, being as soft and pliable as the best buckskin prepared by modern Indians. Deer and mountain-sheep skin robes have already been mentioned. The pelts of these animals were also extensively employed for minor purposes, as in cradle edge-bindings and back-lashings, in fur-string, and for all kinds of strong thongs. The skins of prairie-dogs, being light and soft-furred were always used as covers for infants' umbilical pads.

Bags of all sorts were made of dressed skin, from tiny pouches to hold a few little trinkets, up to large sacks for the storage of corn. Some have the hair on, others do not; but all are very carefully made, the seams neatly stitched with sinew or fine cord and turned inside. The most characteristic bags were produced by sewing together the trimmed skins of two or more prairie-dogs in such a way that the neck of the sack was formed by the heads of the animals, its mouth by their mouths.¹ In some cases as many as seven or eight hides were used.

Sinew. The many references in this report to the use of sinew bindings and seizings give sufficient evidence of its value to the Basket-makers. It was employed whenever a firm flat ligature was desired, as well as for thread in cases requiring extra fine and strong sewing. The kinds of sinew are, of course, not identifiable, but the bunch of it in its raw state shown in figure 15, d, appears to have been taken from some large animal.

Feathers. Feathers were used for the following purposes: in hair ornaments; in pendants; as edgings in fur cloth; for the winging of atlatl darts; and in the make-up of a variety of objects of unknown use which we have classed together as probably ceremonial.

¹ Kidder-Guernsey, 1919, figure 86.

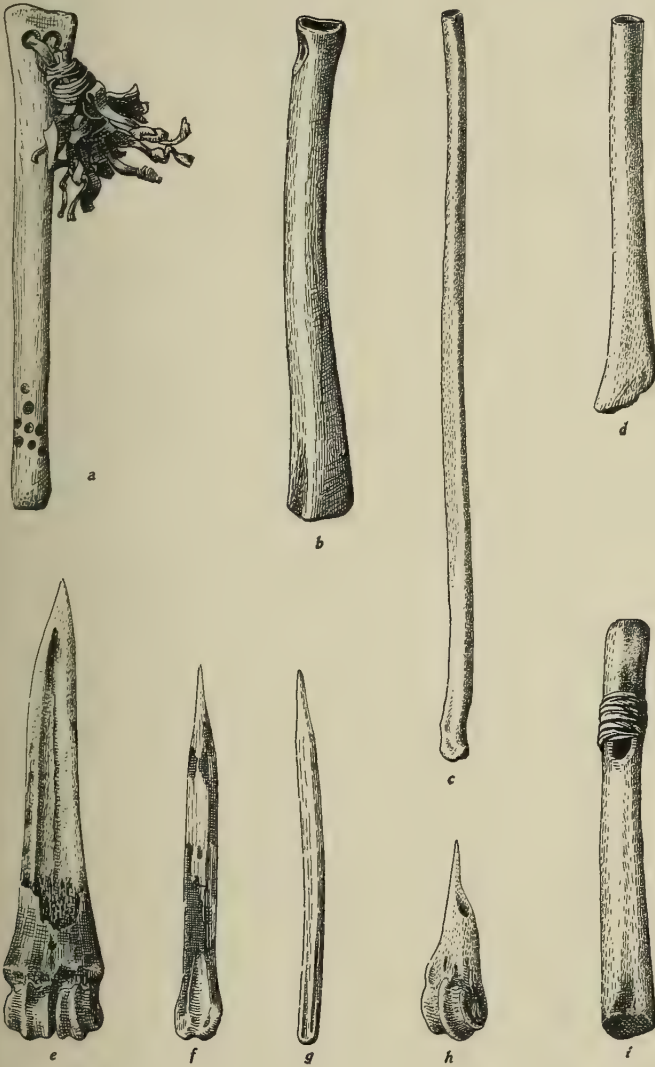
CEREMONIAL OBJECTS

In this section we have grouped all specimens to which we can not assign a definite utilitarian purpose. The nature of many of them leaves little doubt as to their ceremonial or fetishistic use; as to others the case is less clear.

Ceremonial Whip. To one end of a thin, peeled greasewood stick about 20 inches in length there is bound a flat, three-strand braid of shredded yucca leaves, 8 inches long; to the end of this is tied a small bunch of the twigs of the plant called "Brigham tea"; the twigs are 10 inches long, so that the total length of the specimen is a little over a yard. It has the look of a scourge or whip, but its real use is, of course, unknown.

Problematical Objects. In Cist 27, White Dog Cave, were found a number of broken sticks tied together with string. On undoing the bundle it was found that the sticks were fragments of two singular contrivances, the use of which we cannot even guess (plate 36, d, e). One is complete, the upper part of the second is missing. They are slim cottonwood sticks about 7 feet long, their lower ends pointed, and the first foot or so of their shafts soiled and scarred as if they had been repeatedly thrust into gravelly earth. The arrangement of strings at the upper end of the complete specimen is better explained by the drawing than by description. It will be seen that there are two cords running downward from the tip. These are so arranged as to form two adjustable loops along the shaft, the knotted ends of the strings serving to keep these loops from being pulled out by whatever object they were designed to hold.

The object shown in c, is a hardwood branch $27\frac{1}{4}$ inches long. The bark has been carefully peeled and the butt end smoothed by rubbing. For a distance of about 4 inches from the butt the twigs have been cut off close to the main stem; thence to the tip they are also cut off, but their bases have been left long enough to give the object a knobby appearance. The ends of a majority of these protruding twig-stubs are merely ground down to a flat surface; but three, two of which show in the drawing, have neat, shallow, cup-shaped depressions worked in them. The lower four inches of the stick, from which, it will be remembered, the projecting twig-stubs were removed, is discolored and stained as if by having been



WHITE DOG CAVE

a, Handle for deer-hoof rattle; b, c, d, Bone tubes; e-h, Bone awls; i, Bone whistle. (4.)

thrust into damp earth or clay. A little above the middle are two sets of sinew bindings; under the upper one of these are remains of the quills of many small feathers arranged in two groups, one on either side of the shaft. We can offer no suggestion as to the use of this specimen.

Ceremonial Wand. The unique ceremonial object shown in plate 39, b, was found with mummy 2, Cist 24, White Dog Cave; it was wrapped in a bag made of prairie-dog skins, and lay between the right arm and side of the mummy under the fur-string robe which enveloped the body. Details that are not obvious in the drawing are as follows: the handle of wood has a length of $5\frac{1}{2}$ inches; the upper end is carved to represent the head of a bird; the eyes are formed by two small disk beads of shell stuck on with pitch. Adhering to the head about the eyes are tufts of the fine reddish hair of some animal. At the crown of the head there is a slight depression filled with hard gum or pitch in which are a few hairs like those at the side of the head. These may be the remains of a crest, or the result of accident. The appearance of the spot gives the impression that some object about the size of the disk beads which form the eyes, had at one time been fastened here. At the lower end of the handle its under side is embellished for a space of slightly over $1\frac{1}{2}$ inches with cross hatching of fine incised lines. All parts of the handle are nicely finished, and show, particularly at the lower end, a polish due to use. Attached to it by a thong loop are five pendent strings or streamers of thick soft-dressed skin; part of one of these is broken off, the remaining four are each 10 inches in length. These streamers are gathered together at the upper end and secured to the loop by wrappings of sinew. Bound to the upper end of each streamer by sinew seizings are tails of small birds and animals, and feathers. One streamer has five blue feathers, five small brown feathers, and one white and brown feather; the next, one long downy feather, one large dark-colored feather trimmed off at the end and several small brown feathers. The third has the quill ends of two large dark-colored feathers; these are cut down to a length of 3 inches, and placed parallel to each other with the lower ends fastened together by several tight turns of fine sinew; over these are laid a number of small bright yellow feathers; a strand of human hair 3 inches long completes the group. The fourth streamer has

fastened to it six feathers from the tail of some small woodpecker, and two prairie-dog tails. The fifth bears several blue feathers, one trimmed black-and-white feather, the tail of a small animal, the fur of which is about the color of mink, and a very pretty little abalone shell pendant.

The specimen just described, like a number of objects recovered from Cist 24, is in a nearly perfect state of preservation. Wrapped up with it was the small deer tail shown in c, the head of a sapsucker (*Splegrapicus varius muchalis*)¹ a, and what appears to be the end of a bag made of badger skin dressed with the hair on. The bird head is stuffed with fiber or grass, and the tail feathers of the bird, tied together in a bundle, are thrust into the skin of the neck. A Pomo doctor's outfit in the Museum collection contains a number of bird heads stuffed with grass which remind one at once of this specimen.

Ceremonial Bundle. In plate 7, b, can be seen what is doubtless a ceremonial bundle, one end resting in the lap of the mummy, the other projecting above the left knee, this being the position in which it was found.

In the center of the bundle lay a wand-like stick, $14\frac{1}{2}$ inches long, which is shown in b, plate 40. One end has a blunt point, is slightly polished for an inch or more, and is stained a dark red color; the opposite end is rounded and shows traces of fire. To one side of the blunt end and projecting beyond is tied a brush-like arrangement of coarse fiber also stained dark red. The same string which binds the fiber to the stick secures to it a long feather of which there remains very little but the shaft. Other articles tied about the stick and figured in the plate, are as follows:

The curious object, shown in d, more nearly resembles a miniature sandal than anything else, being of the same weave as a certain type of Basket-maker sandal. The strings attached to it are not, however, arranged like sandal tie-strings. There is a dressed skin thong, colored red, woven into one end; this may be an unfinished toe-fringe. The specimen is 4 inches long, and $1\frac{1}{2}$ inches wide. The material is fiber string, except the dark line through the center which is of human hair string.

The blade-like object of tough, close-grained wood shown in f, is $12\frac{3}{4}$ inches long, $1\frac{1}{8}$ inches wide, and $\frac{3}{8}$ to $\frac{5}{8}$ of an inch thick.

¹ Identified by Mr. O. Bangs of the Museum of Comparative Zoölogy, Harvard University.



WHITE DOG CAVE

a, One of a pair of bone tubes showing compound die cemented to upper end;
 b-k, Compound dice. (Enlarged 1/5.)

Both the pointed and the rounded ends are blackened as a result of shaping or hardening by fire. The edges of the blunt end are rounded for something over a hand's breadth; for the remaining distance to the beginning of the point both edges are sharp. One edge is rather keener than the other and shows a surface smoothed by wear.

The foreshaft and point of a throwing spear c, from the bundle is the largest in our collection, measuring over 7 inches in length. The point of red jasper, $2\frac{1}{4}$ inches long, 1 inch wide at base, is set in a notch cut in the end of the shaft and secured by a sinew binding which is still in perfect condition, as is the shaft itself except for traces of decay at the tapering end. This specimen, though our largest, is not as long as the foreshafts in the Lang collection from San Juan County, Utah, now in the Deseret Museum, which, according to the table given by Pepper,¹ are $7\frac{1}{4}$ inches to $11\frac{1}{4}$ inches in length.

The tips of the long feather shown in e, is 7 inches in length; the quill at its upper end for a distance of 2 inches is seized with fine flat sinew as shown in the drawing. Another feather, of which only the quill remains, measured $15\frac{3}{4}$ inches in length.

Wrapped about the bundle were the remains of a feather head-dress not unlike the feather crowns used by various California tribes in their ceremonies. The method of tying the feathers is shown in the illustration, a; the same knot is also used by the Wailaki and Shasta Indians, specimens of which are in the Museum collection.

Ceremonial Bone Objects. In plate 41, e, will be seen what appears to be merely a pair of bone tubes, but which is in reality a nearly complete example of a very puzzling type to which belong all the other bone specimens illustrated in the plate. To make clear the relationship of these objects a detailed description is necessary.

The two halves of this contrivance are tied tightly together with a strip of yucca leaf. The right-hand unit of the pair is a hollow bone, $6\frac{5}{8}$ inches long, highly polished as if by long use; its upper end is solidly plugged with a dark pitchy substance, the edge of the orifice is cut by six small V-shaped notches; the lower end shows signs of having once been similarly plugged, but is now open; just above the orifice there are two small round holes, drilled directly

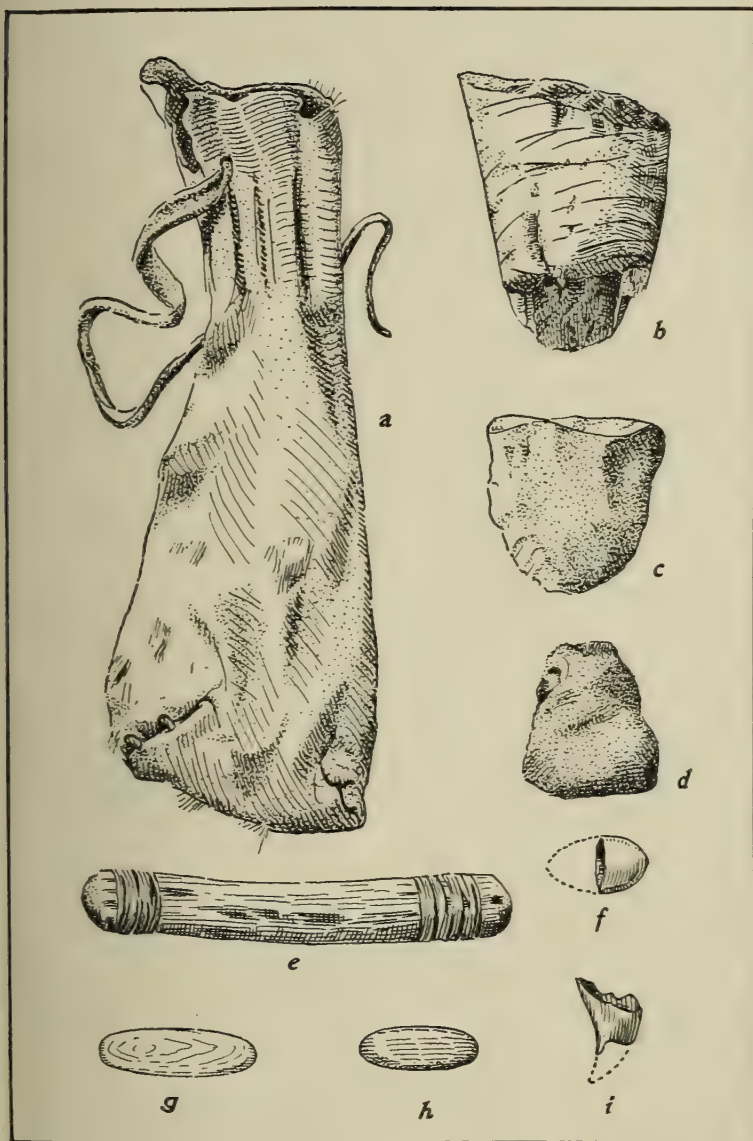
¹ Pepper, 1905, p. 129.

opposite each other (only one shows in the drawing). The left-hand unit is made up of two bones of equal length fastened to each other by being pushed together over a round stick which fits very tightly in their hollow interiors; the joint is further secured by a sinew cord laced back and forth through series of little holes drilled close to the edge of each bone (three of these holes may be made out in the drawing, the rest are hidden by the main yucca leaf binding). Just below the upper end of this compound bone are two horizontal lines of small round pits, or incised dots; these only run half way around and do not appear on the back. The end of the lower piece is pierced on one side by a small hole, and just above the orifice there is scratched a single encircling line. Neither end of the left-hand unit gives any indication of having been plugged as were both orifices of the right-hand bone.

The fragments of the specimen shown in d, are assembled in what were doubtless their original positions. They form a pair very similar to the one just described, but both halves are compound, each being made up of two pieces once held together by an interior stick or dowel. Parts of a main binding that once fastened the two halves to each other are still preserved. The lower part of the left-hand unit has on one side three deep horizontal notches and a single small round hole; the upper piece has three double lines of incised dots which, as in the preceding specimen, only run half way around. The right-hand unit has two similar double lines of dots, one near the bottom, one just below the top. The upper end of each unit is plugged with pitch, in which are set the curious compound objects shown in the drawing. They are flattened spheres of red stone with small, white, perforated discs glued to their tops. The right-hand sphere has been somewhat warped from its original flat position across the end of the bone.

The pair of tubes shown in f, were found together in Sunflower Cave and illustrated in our first report (plate 86, f); they are reproduced here because they are surely of the same nature as the White Dog Cave specimens. They fit snugly when laid side by side and show, indeed, signs of rubbing along the points of contact; hence they once were undoubtedly bound together. Near the upper end of each one, and running only half way around,¹ is an

¹ In our first description we mistakenly stated that the dots encircled the bones (Kidder-Guernsey, 1919, p. 189).



CAVE 6

a-d, Skin pouch and objects found with it in woven bag; e-i, Articles from within pouch. (About 4/5.)

incised line and a row of dots. If pitch was ever used to plug up these bones, it has entirely disappeared.

Two other bone objects (g and h) are fragments which obviously formed parts of pairs identical with the above. They are of the same general shape and size, and have similar rows of small dots only partially encircling them. The upper one, g, is the best preserved of several fragments of a broken specimen; found loose in the same cist with it were four compound "buttons" very like the ones glued to the ends of the pair shown in d.

To sum up: these objects were pairs of bones tied together at the middle; the component parts of each pair might be a single bone, or might be made of two bones fastened end to end. All are decorated with lines of dots, and many, perhaps all, had at one place or another small drilled holes. Some at least were provided with compound "buttons" glued to their ends. The fact that the incised dots never completely encircle the bones, and that the undotted surface of each bone is always the flatter side, seems to indicate that these assemblages were held or worn against something in such a position that one side was not visible. We have only one hint as to a possible use; lying close against the central ligature of the pair figured in d, and apparently engaged by it (the specimen is badly rotted) was a cord hung with nearly a hundred deer-hoofs. The latter may have formed a rattle, and if so, the double bones might perhaps have been some sort of handle for it.

Included here because they were found in the same cists with some of the pairs just described, are two specimens that seem to have served as handles for what we suppose to have been ceremonial wands.¹ The first (plate 42, a) came from the same cist that held the broken paired bones above described. It is a hollow bone, 5½ inches long, the lower end carefully finished, smoothed, and decorated with eight circular cup-like depressions filled flush with black gum. At the upper end it is perforated by two holes through which runs a narrow thong holding a number of other thongs; the ends of such of the latter as are not broken off are knotted about the remains of the butts of small feathers; the ends of the others are simply knotted. The second specimen, b, from the same cist as e and h, plate 41, is a plain tube with a single hole at one end; its similarity to the above handle is obvious.

¹ Compare the bird-headed wooden handle with feathered streamers, plate 39.

Bone Whistle. The specimen illustrated in plate 42, i, was found with the handle last mentioned, one of the complete pairs of bones, and one fragmentary one. Its length is $4\frac{1}{2}$ inches. The lower end is tightly closed with gum, the upper is unsealed. The single rather large opening is partly covered by wrappings of sinew; these seem to have held a bit of reed or other substance, now almost rotted away.

Bone Tubes. The tubes shown in c and d, are both simple lengths of hollow bones with carefully cut ends. They are figured here because we are unable to assign any definite utilitarian function to them.

Compound "Dice." The extremely well-made little objects shown on plate 43, are all from White Dog Cave. Each consists of two parts: a spherical or cylindrical body with rounded bottom and flat top; and a cap, which is a thin disc (often a reused bead with the perforation plugged with pitch) firmly cemented to the flat top of the body. The variety of materials used in their manufacture will be brought out in the descriptions which follow.

The upper and lower sides of the largest example we have is shown in j, k; it measures $\frac{3}{4}$ of an inch in diameter. The body, of highly polished lignite, is perforated vertically, but the hole is carefully plugged; about the lower edge there runs a series of little cuts. The cap is a fine grained red slate disc-bead, the perforation filled with pitch. This specimen, the only one in the lot which was found singly, came from Cist 52.

One of a set of four from Cist 22, is shown in h. It has a translucent quartz body and a cap of red slate. The other three (not figured) are of lignite; one has an unperforated white bone cap, the caps of the remaining two are missing, but dried cement on the flat tops of the bodies proves that they were once present.

A set of seven was found in a small buckskin pouch in Cist 24. One of these, i, has a dark brown wooden base and a white bone cap; a second, f, has a lignite base with an unusually large white limestone cap; the one shown in g, has a lignite base and a light brown stone cap; b, has a long cylindrical base of lignite and a cap of hard light green stone (not turquoise); the fifth (not figured), a lignite base, and light brown stone cap. The sixth, d, and seventh are of a very peculiar construction which was not suspected until one of them accidentally split in halves. It proved to have been made

by rolling up a tiny pellet of gray clay mixed with grains of crushed azurite and malachite. Around this pellet was added a thin layer of the same mixture, then another and another like the coats of an onion, until the requisite size and shape of the base were attained. The whole was then daubed with pure gray clay, so that the blue and green particles, so thickly sown through the whole interior, do not show on the surface. The cap of the one figured is a flat green stone, that of the split specimen is of red slate; both are about the same size.

A second set of seven, also contained in a buckskin bag, was taken from Cist 24. These are not figured. Two are of lignite with unperforated brown stone caps; four are of the peculiar azurite-malachite-clay composition, the caps of two are missing. Of the two in place one is a perforated brown stone disc, the other an unperforated disc of green stone. The seventh is beautifully shaped from hematite, it lacks the cap, but, as in all such cases, distinct traces of the cement that once held it in place remain.

Two of another set of seven found loose in Cist 27 are also illustrated in plate 43. The one shown in c, is a hard, light green stone with a cap of white bone; e, is of serpentine and lacks the cap. Of the remaining five, one is sandstone of thin cylindrical form; like e, the cap is missing; the other three have green stone bases with bone, pink stone, and red stone caps respectively.

The purpose of these pretty and beautifully made little things is unknown. Two of them were found glued to the ends of bones (plates 41, d, and 43, a), and the set of four above described came from a disturbed cist (6) which contained fragments of similar paired bones. We at first thought that all such "buttons" were meant for a like use, but on careful examination we could find no trace of pitch or other adhesive matter clinging to any of them; furthermore their bottoms are always excellently finished and show, indeed, more polish than do the sides, whereas objects primarily designed to be glued or cemented to other objects, are generally roughened on those parts which were destined to receive the adhesive substance. This, and the fact that we have three separate sets of exactly seven each, has inclined us to believe that they were some form of dice and that their employment as an embellishment for the tips of the peculiar paired bones may have been a secondary one.

MEDICINE POUCHES OF SKIN

Under this heading are included a number of skin bags of various shapes and sizes which were found with burials. They contained assortments of miscellaneous material, much of it of no apparent practical value.¹ As to whether or not the identification of these sacks as medicine pouches is correct, the reader may judge for himself.

Bag and Contents. The container figured on plate 38, a, is made from prairie-dog skins with the hair on, cut and fitted to form a triangular sack 11 inches long, 10 inches across the base, and $3\frac{1}{2}$ inches across the mouth. The skins are arranged so that the heads



FIGURE 16

Skin bag containing beads and feathers, White Dog Cave. ($\frac{1}{4}$.)

form the mouth of the bag. They are sewn together with a running stitch, the seam inside, the hair side out. Within were a cake of paint, b, and a very small skin bag, c, wrapped with string and holding powdered paint of a brilliant green color. The cake was made of the same paint, apparently moistened and molded into its present shape with the fingers.

Bag with Colored Minerals. This is a little skin container in which were found about twenty small unworked fragments of azurite and malachite.

Dice Bags. These were both taken from Cist 24, White Dog Cave. They are little buckskin bags; each contained seven of the peculiar compound "dice" described above.

Sack with Beads and Feathers. This specimen is illustrated in figure 16. It is a bag of what appears to be badger skin with the hair on, which is somewhat rotted and has split down the side. In

¹ Similar assortments were found with Sayodnechee burials. Kidder-Guernsey, 1919, p. 30.

it are about a teacup full of small cylindrical black seed beads; a few discoidal bone beads; and six large flat stone beads, two of which are of alabaster. There are also eleven large hawk feathers and a section 7 inches long broken from the stalk of a plant with a pithy stem.

Pouch and Small Articles. This heterogeneous assemblage (plate 44) was found in the woven bag shown in plate 30, d, taken from Cave 6. Some of the objects were loose in the woven bag, the remainder were contained in the little skin pouch, a, of the former plate. The latter is made from a piece of thin animal hide, soft dressed with the hair on, folded to form a small, narrow sack 5 inches long, and sewn with fiber string. After having been sewn it was turned to bring the seam inside. A buckskin tie-string is attached to the top. Only traces of the fur remain.

The objects found loose in the woven bag are: a fragment of a fossilized mammalian tooth, b; a piece of hard yellow ochre showing rubbing facets, and grooves such as might have been made by coloring a cord, and in spots, a curious gloss, c; a small lump of organic substance resembling dried fruit, d; and half of a squash seed, f.

In the little skin pouch were: a part of the horny claw cover of an animal, presumably dog or wolf, i; an oval bone die, g, similar to those figured in our first report,¹ except that both sides are convex, instead of one being convex and one flat; a wooden die of bi-convex shape with one surface coated with pitch as in the 1915 examples just referred to, h. The remaining specimen from the pouch is a section $2\frac{3}{4}$ inches long cut from a grease-wood stick, e. The ends are rounded and wrapped with sinew, and a groove runs the whole length of the under side, the entire object having been painted a dull red.

SUMMARY AND CONCLUSIONS

Summary of Material Culture. Of the dwellings of the Basket-makers we know next to nothing. Certain crudely-built stone structures in Goat Cave (plate 2, a, b) may be Basket-maker, but the evidence is not conclusive. In Cave 14 were found cists made of large slabs and closed over with conical wood and adobe roofs;

¹ Kidder-Guernsey, 1919, p. 189 and plate 86, g.

these were built above ground and against the cliff-wall (plate 9, e, f). There is little doubt in our minds that they are Basket-maker products, and they have a distinctly house-like appearance but their very small size argues for their use as storage places rather than as domiciles. We believe at present, therefore, that the Basket-makers lived mostly in perishable structures built in the open, and only resorted to the caves for temporary shelter in severe weather.

Although they apparently did not live regularly in the caves, they took full advantage of them for the storage of their crops and for the burial of their dead. For both purposes they used cists. These occur in several well-defined varieties (see plate 9). Where the cave floor was of solid hard-pan they excavated plain, jar-shaped cavities in it; some of these have little tunnels or "flues" leading to smaller, shallower holes set about their mouths. When the floor of the cave was of material so loose as to render the above forms unpractical, they scooped out holes, larger or smaller according to their requirements, and lined them with large, flat, stone slabs to hold back the sand. These are the commonest types, and served, apparently, either for storage or burial. Semi-subterranean (Cave 2, 1915), or above-ground cists (Cave 14) with slab foundations and adobe superstructures complete the list; we have so far not found burials in them.

Burial customs were very uniform; the bodies were flexed, wrapped in fur-string blankets and twined-woven bags, and deposited, with numerous mortuary offerings, in the cists. Interments were almost never single; in most cases two to four individuals were buried together.

The Basket-makers grew corn of a single, apparently primitive variety; squashes also were raised, but the most careful search has so far failed to reveal any evidence of bean culture. The turkey was probably not domesticated. The people covered themselves with robes of fur cloth and dressed hides; men wore a breech-cloth and "gee-string"; the women a short string skirt. The usual footgear was the square-toed sandal, a type which differs from all others in the Southwest in shape, in the presence of a toe-fringe, and in the fact that the soles of the better specimens are provided with a looped "pile" reinforcement covering their entire length.

Children and the adults of both sexes were well supplied with necklaces of stone and shell beads, as well as with pendants of stone and abalone shell; turquoise, apparently, was unknown. Hair-dressing in the case of males was elaborate. The back hair was gathered into a short chubby knot to which was fastened a thin braided scalp-lock falling from the crown of the head; there was often a wide "part" and a tonsure from which the hair was clipped close. Women seem to have worn the hair short; their heads may have provided the great quantity of human hair that was used for string.

Cradles were of two types: the rigid, with wooden frame, twig or reed backing, and padded edge; and the flexible, made of grass or cedar bark. Young babies were always provided with stuffed pads, bound to the navel to prevent rupture.

Basketry was very abundant indeed, but was exclusively of the coiled variety, with two-rod-and-bundle foundation, and with wooden sewing splints. The weave is coarse, but even and very firm; decoration is in black or black-and-red; the designs have a sort of family resemblance to those of the modern tribes of central and northern California. The principal forms are trays, bowls and large panniers. No wickerwork, twined or checker-work baskets were found.

Of textile fabrics, these people turned out very limited amounts of apocynum string cloth, plain over-and-under weave. It was undoubtedly woven on some form of loom, but the small size of the individual pieces produced and the crude nature of the selvages give the impression that the art of loom weaving was still in its infancy. This theory is strengthened by the fact that the designs were either painted on the fabric or made by rubbing color onto the wefts as they were being woven, rather than produced, as in more perfected systems, by the use of separate wefts dyed before insertion. The most elaborate textiles are the hand-twined bags, usually made of apocynum string, and decorated by painting or by rubbing color on the wefts in process. The abundance of such bags is very striking. Although an enormous quantity of finely spun string was employed for the textiles and for a variety of other purposes (such as in rabbit-nets, string aprons, fur cloth, etc.), we have never found any trace of the use of a spindle, either plain or whorled. Fur cloth was much used, true feather-cloth never.

Skin was well dressed and entered into many industries, but most strikingly so in the making of all sorts of small to medium sized bags and pouches, the most characteristic of which are sacks formed of two to seven or eight prairie-dog hides sewed together in such a way that the heads of the animals arranged side by side formed the necks of the bags.

The Basket-makers had few superiors in the careful working of wood; their weapons and implements show as fine shapes and as perfect finish as can be achieved with stone tools. The most typical objects are the atlatl and dart (used, apparently, to the entire exclusion of the bow and arrow); the grooved club; and the crooked shafted, plain-gripped digging stick.

Artifacts of stone are very poorly represented in the collection. There are no specimens of the following types, all common in the cliff-houses and pueblos: axes, both grooved and grooveless, hammer stones, polishing stones, "sandal lasts," chipped scrapers, arrowheads, or long drills. As these lacking forms are all strictly utilitarian in function, their absence may be due to our material being almost exclusively from graves and temporary cave-shelters, rather than from long inhabited dwelling places. It would not surprise us, however, to find that the grooved axe was unknown to the Basket-makers, as that implement among the northern Cliff-dwellers is always of a rude, unspecialized type and therefore presumably of late introduction. The grooved axe is, indeed, entirely absent from the areas to the west and northwest of the Pueblo district.

Of such stone objects as do occur, the most characteristic are the heavy discoidal and sub-spherical beads, the short squat pipes and the large, triangular, tanged dart-points. The chipping of the latter, and of certain large flint knife-blades, is very skillfully done.

Bone tools, like those of stone, are not common in our collection: there are a few simple awls, a few beads, some whistles, and some pairs of decorated tubes which we have classed as ceremonial. There are no bone scrapers. The rarity of awls, among the remains of a people who produced as much coiled basketry as did the Basket-makers, is very peculiar; it is probably due to the fact that we have not yet succeeded in finding long-occupied dwelling places.

While feathers played an unimportant part in the making of obes, having been used only for fringes and ornamental borders, they were much employed in the making of all sorts of ceremonial paraphernalia, as well as for the winging of atlatl darts. Bundles of large feathers, destined probably for the latter purpose, were found in several caves.

True pottery, as far as we know, was not made. The only specimens of burned clay that we have are two small pipes found in 1914-1915. In the present report is described a fragment of an unfired dish with basket marked exterior; this may represent a very primitive form of pottery. In which case again we feel the lack of material from village sites, as it is possible that pottery really did exist but that it never, for some reason, found its way into the graves.

As to pictographs, we only know that the painting of large square-shouldered human figures on the walls of caves was a typical, and apparently an exclusive Basket-maker practice. We have never been able to identify any pecked pictographs as of Basket-maker origin.

Conclusions. Before entering into any discussion of the place of the Basket-makers in the general scheme of Southwestern archaeology, it must first be demonstrated that their culture is really a distinct one. If this cannot be done, if the so-called Basket-maker remains from Grand Gulch and the Kayenta region are to be considered as only a specialized local phase of the widespread Pueblo-cliff-dweller civilization, then they naturally cease to have any chronological or morphological interest. The authors, however, feel sure that such is not the case; a summary of the evidence follows.

The cliff-houses and pueblos of this region are stone-built dwellings of coursed masonry, laid up with adobe mortar; the rooms are rectangular. Corn of several varieties was cultivated, as well as beans and cotton; the turkey was domesticated. Of the minor arts, the most important was pottery making. Equally characteristic are: twilled yucca leaf sandals, twilled rush matting, and twilled ring-baskets, cotton loom cloth, turkey-feather string, and the bow and arrow. These objects, together with pottery, make up nine-tenths of any collection from the cliff-houses. Turning to the graves, we find that Cliff-dweller skulls were always artificially

flattened at the back, and that the bodies, accompanied by generous offerings of pottery, were interred in individual graves, usually in the open.

The Basket-makers, on the other hand, certainly built no houses of coursed masonry; they may, in fact, have possessed no more permanent dwellings than do the Navajo of today. Their corn was of a single, rather primitive, variety; they were ignorant, apparently, of beans and cotton, nor did they domesticate the turkey. They made no pottery worthy of the name (or if they did, it never found its way into the graves), and all the other characteristic Cliff-dweller specimens mentioned above are conspicuous by their absence. They are replaced, however, by such equally characteristic Basket-maker products as the square-toed sandal, the twined-woven bag, and the atlatl. The heads of the Basket-makers were never artificially deformed. The graves, instead of being in the open, were cists excavated in the hard-pan or the sandy fill of caves, and from two or three to ten or more bodies were placed in each cist. Mortuary offerings were numerous and varied, but the one invariable gift to the dead was coiled basketry.

In the above summaries only the leading traits of the two cultures are catalogued. A more detailed comparison in tabular form has been published elsewhere,¹ but enough is here presented to show the essential differences between them, particularly when it is considered that all finds of each class have always run true to form: pottery, for example, and deformed skulls have never appeared in Basket-maker graves; the rubbish of cliff-houses has never given evidence of the manufacture of, for instance, twined-woven bags or the atlatl.

We may now take up the question of age. Here again we are on firm ground. The Basket-makers definitely antedated the Pueblo-Cliff-dweller people. This was stated long ago by the Wetherills and McLloyd and Graham,² and was proved to us by the superposition of Cliff-dweller remains upon Basket-maker burials in Sunflower Cave. Even without this clear stratigraphic evidence, the case was reasonably certain, for in several of the other sites investigated we found cliff-house pots or sherds in surface-sand overlying Basket-maker burials but never in the graves themselves. Furthermore, during the 1915 work in Sunflower Cave there was

¹ Kidder-Guernsey, 1919, p. 204.

² Pepper, 1902.

taken from the cliff-house rubbish a square-toed Basket-maker sandal.¹

We have proved, to our own satisfaction at least, that the Basket-makers were a people culturally distinct from the Cliff-dwellers; and also that they antedated the latter. At this point definite knowledge ceases; and to the very important questions of the origin of the Basket-maker culture, and of its relation to that of the Cliff-dwellers, we can supply only conjectural answers.

As to origin, it may be said that several traits, such as corn growing and the use of the atlatl, point toward Mexico. The peculiar curved, grooved hand-club, and the method of hair-dressing were both features of the somewhat Mexicanized Maya culture of late prehistoric and early historic times in Yucatan. Furthermore, the only archaeological finds which remind one of the Basket-makers have come from the Coahuila caves in northern Mexico, and from the Tularosa caves in southern New Mexico. The latter sites lie roughly half way between the Kayenta region and Coahuila. Just how much weight should be attached to these bits of evidence we do not know, but it seems to us certain that germs of the culture worked northward from the Mexican highlands in very early times.

Although the question of their origin is obscure, we know at least that the Basket-makers were living in the lower San Juan country prior to the opening of the Pueblo-Cliff-dweller period. As to the relations of the cultures two hypotheses suggest themselves: first, that the Basket-makers were a distinct people who were crowded out of the region by the arrival of their more highly developed successors; second, that they were the direct ancestors of the latter.

If the first hypothesis be correct we need not postulate any great time interval between the two cultures; as one came in, the other was destroyed or moved away. If, on the other hand, we believe that the one developed from the other, we must be prepared to allow a very considerable time for the transition, for there are many radical differences between the cultures; and we have so far

¹ This illustrates an important principle of archaeological evidence, viz.: Given two cultures, A and B, in the same area; if A objects are found in B sites, but B objects never in A sites, A may be safely considered older than B. The sporadic finding of Basket-maker products in cliff-houses may be expected in the future, particularly as it is probable that the frequent spoliation of Basket-maker burials was the work of the Cliff-dwellers.

sought in vain for any trait running from the one to the other through an unbroken logical and surely demonstrable evolution. While there are missing links in every such chain, it is possible that in this case some of them may yet be supplied by the hitherto little-known "pre-pueblo" or "slab-house" sites that archaeologists are beginning to uncover in various parts of the Southwest. All such sites hitherto examined have, however, been found in the open and so have yielded no specimens of a perishable nature; hence they have provided us with no evidence as to basketry, sandals, food products or wood-working, the very phases of material culture with which we are most familiar in the case of the Basket-makers and which we therefore most need for comparative and developmental studies. A rigorous search should accordingly be made for "pre-pueblo" habitations and graves in locations where they may be expected to be found protected from moisture. If such are discovered, it should be an easy matter, in view of our accurate knowledge of both the Basket-makers and the developed Cliff-dwellers, to determine definitely whether or not the "pre-pueblo" people were culturally intermediate between them.

To return to the first hypothesis, namely, that the Basket-makers were crowded out of the region by the Cliff-dwellers, and settled somewhere along its edges. We have examined collections from many modern southwestern tribes who possess cultures of about the same grade as that of the Basket-makers, in the hope that we might find some evidence of their descent from the ancient people. Nothing definite could, however, be established, although similarities in basketry, rabbit-nets, and hair ornaments were noticed in the Paiute collections; and, among the Mohave material, in the form and weave of twined bags and in the practice of plugging with wood the quills of feathers. Too much significance, however, must not be placed upon similarities such as the above, for the remarkable state of preservation of the Basket-maker material makes it appear so much like a collection from an existing tribe that it is particularly easy to fall into the way of drawing technological comparisons between it and modern articles, losing sight of the fact that the Basket-maker products are really of great antiquity and that the Paiute, Mohave, and other collections are things of yesterday. Where similarities occur, therefore, their significance as showing direct connection is open to question; the

long time interval has permitted the working of too many as yet unassayable factors of culture-growth and transmission.

It may seem to the reader that we have been unduly cautious in our failure to draw any definite conclusions. The work, however, is just beginning, and it is our desire to do no more than record for other students the evidence so far accumulated, and to present the few speculations as to its meaning which we have allowed ourselves to indulge in.

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PAPERS

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VOL. VIII. — No. 3

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TURNER GROUP OF EARTHWORKS
HAMILTON COUNTY, OHIO

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TO THE MEMORY OF
FREDERICK WARD PUTNAM

1839-1915

PIONEER OF SYSTEMATIC MOUND EXPLORATION
IN OHIO, UNDER WHOSE DIRECTION THE WORK
DESCRIBED IN THIS PAPER WAS CONDUCTED

NOTE

IN 1882, Mr. Michael Turner, on whose estate the group of earthworks described in the following paper was situated, gave the Peabody Museum of Harvard University the exclusive right of exploration. Previous to this date, the larger of the two tumuli within the elevated circle was known locally as the Whittlesey mound, in honor of the archaeologist who briefly described a portion of these remains in a paper published in 1850. Professor Putnam made arrangements with Dr. Charles L. Metz of Madisonville, to carry on the exploration, which was begun in May, 1882, and was continued as funds and time would permit, until the autumn of 1891. Little was done subsequent to this date. Mr. Volk explored several graves in 1905, and final work on mound 15 was completed in 1908. In the third volume of the Reports of the Peabody Museum, Professor Putnam has given brief notices of the investigations as they progressed, and has also called attention to some of the more important discoveries.

CAMBRIDGE, MASSACHUSETTS

March 1, 1922

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THE TURNER GROUP OF EARTHWORKS HAMILTON COUNTY, OHIO

THE WORKS IN GENERAL

Neighboring Groups. The Turner Group of Earthworks is situated in Anderson Township, Hamilton County, Ohio, upon the left bank of the Little Miami River, about eight miles from its junction with the Ohio River. The valley of the Little Miami is one of the richest archaeological fields in the state. Mounds and other earthworks dot its surface. Within a comparatively short distance from the Turner Group are numerous mounds and small enclosures, which apparently have no direct connection with this group.

Some two or three miles to the northeast are the extensive Milford Works, comprising parallel embankments and enclosures of varying forms, together with a number of mounds. A mile or two to the north, across the Little Miami River, lie the Camden Works, consisting of a square and circular enclosure with connecting embankments. Several mounds belong to this group. The Milford and Camden Works were surveyed many years ago by General Lytle of Cincinnati. The plans were reproduced by Squier and Davis, who describe them briefly.¹ A few less important detached works, in the form of circles, parallelograms, and parallel embankments, lie not far distant.

Superficially, there is little resemblance between the Turner, Milford, and Camden Works. It is probable, however, that the purpose served was the same. In each of these neighboring groups, a lesser enclosure of circular form is connected with a greater enclosure by parallel embankments. In two instances, the lesser enclosure is situated upon an elevated terrace as though for additional security. It is probable that the larger enclosure contained the habitations and certain ceremonial buildings. The

¹ E. G. Squier and E. H. Davis, *Ancient Monuments of the Mississippi Valley*, Smithsonian Contributions to Knowledge, Vol. I, plate xxxiv, Nos. 1 and 2a.

smaller enclosure may have been for defensive purposes, or perhaps was the site of the council house or principal public structure.

General Description of the Turner Group. The first account of these works is by T. C. Day in an article entitled *The Antiquities of the Miami Valley*, published in the Monthly Chronicle for November, 1839. This description refers principally to the elevated circle and graded way, and is quoted by Dr. Metz in his *Prehistoric Monuments of the Little Miami Valley*.¹

It is situated on a ridge of land that juts out from the third bottom of the Little Miami. . . . Its probable height is 40 feet, and its length about a quarter of a mile before it expands out and forms the third alluvial bottom. About 150 yards from the extreme point of this ridge, the ancient workmen have cut a ditch directly through it. It is 30 feet in depth, its length, a semi-circular curve, is 500 feet, and its width at the top is 80 feet, having a level base of 40 feet.

At the time of its formation, it was probably cut to the base of the ridge, but the washing of the rains has filled it up to its present height. Forty feet from the western [northern] side of the ditch is placed the low circular wall of the fort, which describes in its circumference an area of about 4 acres. The wall is probably 3 feet in mean height, and is composed of the usual brick clay, occasionally intermixed with small flat river stones. It keeps at an exact distance from the top of the ditch, but approaches nearer to the edge of the ridge. The form of the fort is a perfect circle, and is 200 yards in diameter. Its western [northern] side is defended with a ditch, cut through the ridge in the same manner as the one on the eastern [southern] side. Its width and depth are the same, but its length is greater by 200 feet, as the ridge is that much wider than where the other is cut through. The wall of the fort keeps exactly the same distance from the top of this ditch as of the other, viz., 40 feet. Its curve is exactly the opposite of that of the other, so as to form two segments of a circle. At the southeastern side of the fort there is an opening in the wall 36 yards wide; and opposite this opening is one of the most marked features of this wonderful monument. A causeway extends out from the ridge about 300 feet in length, and 100 feet in width, with a gradual descent to the alluvial bottom at its base.

The material of its construction is evidently a portion of the earth excavated from the ditches. Its easy ascent and breadth would induce the belief that it was formed to facilitate the entrance of some ponderous vehicle or machines into the fort. To defend this entrance they raised a mound of earth 7 feet high, 40 wide, and 75 long. It is placed about 100 feet from the mouth of the causeway, and is so situated that its garrison could sweep it to its base. The whole area of the fort, the wall, and causeway are covered with large forest trees, but there is not a tree growing in either of the ditches, and there are but a few low underbrush on their side.

¹ *Journal of the Cincinnati Society of Natural History*, Vol. I, No.3, 1878.

The next account is by Charles Whittlesey and was published by the Smithsonian Institution in 1850. It includes a description of the elevated circle, the graded way, a portion of the great enclosure, and some of the mounds. At that time the elevated circle and graded way were covered with a mixed growth of hard wood. This is said to have been removed in 1856. The lumber was cut from portions of the great enclosure about 1816, and the ground first plowed by Benjamin Marriott in 1825.¹ At the time of Whittlesey's brief survey, the mounds and embankments of the great enclosure had probably been reduced somewhat by cultivation, but the elevated circle and graded way had not been plowed. The following account by Whittlesey, together with his plan (figure 1), is reproduced through the courtesy of the Smithsonian Institution:²

Among the curious structures of the mound-builders, there are none more difficult to explain than this. On a detached ridge, composed of limestone gravel, covered with a clay loam, is a low wall, averaging 2 feet high, and 15 feet broad, nearly in the form of a circle; although its north and south diameter is about 25 feet the longer. The average diameter of the circle is 470 feet. The flat ridge on which figure A is situated, is about 25 feet higher than the adjacent plain, which is from 25 to 35 feet above the Little Miami River. Outside of the circular figure, there is a space from 20 to 30 feet wide, on the natural surface of the ground. On the two opposite sides of the circle, where it occupies the height of the ridge, is an external ditch, or excavation, enclosing about half the figure. It is from 70 to 85 feet broad at the top, and from 12 to 18 feet deep. The bottom of this trench is not smooth, and is from 7 to 10 feet higher than the adjacent plain. Its sides are as steep as the gravel and earth will lie. On the east, in the direction c, g, is an embankment or grade, extending by a gradual slope, from the enclosure A to the plain. It is 168 feet wide at the neck, where it joins A, and has, at the edges, raised side-walls, like those made for pavements in cities, with a drain or gutter inside. The space between the side-ways is rounded like a turnpike, as represented in the section d, e. Its length is 600 feet, and the side-ways are connected with a low and now almost obliterated wall, turning outwards each way at i, i. Some distance to the northeast is another traceable fragment, f, f; and this may, with i, i, have been portions of a large ellipse, now destroyed by time and cultivation.

The earth from the outside ditches of A was used to form the embankment c, g, through which a rivulet has cut its way near the eastern extremity. The small circle at c represents a mound 8 feet high, a little out of the center of

¹ F. W. Putnam, Manuscript Notes.

² Charles Whittlesey, *Descriptions of Ancient Works in Ohio*, Smithsonian Contributions to Knowledge, Vol. III, No. 7, pp. 9 and 10.

the work. The group of mounds, m, m, m, are from 2 to 14 feet in height. B is a circle, with a slight inside ditch, and a broad opening for an entrance.

The section, a, b, gives the position of the ditch, n, the bank, o, and the space of 30 feet between them, called a berme.

There are some examples of graded ways among the ancient works of Ohio, but none resembling this. The grade at Marietta leads from a strong work

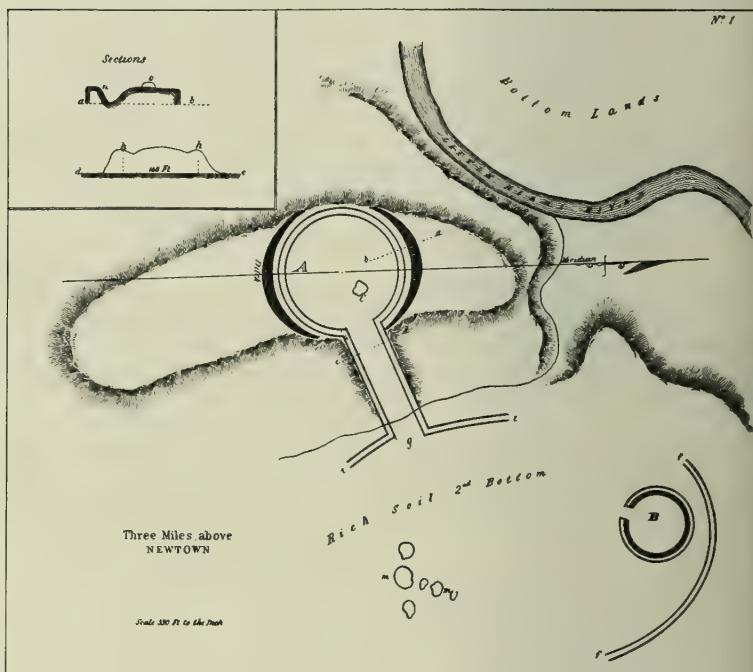


FIGURE 1

Whittlesey's plan of the Turner Group, 1850.

down to the Muskingum River, and had an evident purpose, that of access to water. It is principally an excavation and not an embankment. There is also a grade, partly in excavation and partly in bank, from a portion of the Newark Works in Licking County, leading to a branch of Licking or Pataskala River.

The great excavated road at Piketown, likewise descended to water. But here, a grade that might with as little labor have been constructed in a direct line to the Miami River, is made in the opposite direction, away from water. I should judge that the rivulet was not a permanent stream, and therefore

could not furnish a constant supply of water. Besides, the graded way instead of terminating at this rivulet, crosses it, and probably by an ancient culvert or sluice, allowed the water to pass under the road.

Without taking such measurements as would be sufficient to estimate the contents of the ditch in cubic yards, it appeared to be about equal to the embankment in capacity. The section a, b, gives its form, and the position of the low interior wall.

It is not improbable that there may have been outworks connected with this remarkable group that were not seen, or which have been destroyed by the plough.

The plan of the group shown in plate 1, is adapted from the survey by D. S. and J. A. Hosbrook of Cincinnati, made for the Peabody Museum in 1887. Cultivation for thirty-seven years since Whittlesey's plan was prepared has probably still further reduced the mounds and embankments.

The principal earthworks consist of a great oval enclosure situated on the second terrace of the Little Miami River, about 1000 feet from the river's edge. This enclosure is about 1500 feet long (nearly a third of a mile), and approximately 950 feet wide. At the northeastern end of the oval is an opening or gateway. At the southwestern end is a second opening which connects with a graded way about 600 feet long, leading to an elevated circle upon a portion of the first or upper terrace, which had been detached from the main part of the elevation by two deep trenches, one upon either side. This elevated circle is about 30 feet above the level of the great enclosure.

Within these two connected enclosures are two small earth circles with inner trenches, and fourteen mounds, occupying the positions illustrated in the plan and model, plate 1 and figure 2.

Eight hundred feet south from the elevated circle is the entrance to the long enclosure with low parallel embankments and rounded ends. This is nearly one-half mile in length and about 250 feet in width. This is probably analogous to the chunkey yard of the Creeks, where games were played and prisoners exhibited.

To the west of the elevated circle are four mounds upon the second terrace, regularly arranged in relation to the circle. To the north of the great enclosure and upon the third terrace at the river's edge is what is left of a stone-covered mound which has been partially carried away by river floods. Upon portions of the first terrace to the southward are several other mounds, not shown in

the plan, which probably bear no direct relation to the group under consideration.

The Embankment of the Great Enclosure. The embankment forming the great enclosure could be traced practically throughout its entire length. Beginning at the foot of the graded way, about one-half of the northwestern section was well defined except in one place, the average height being about 2 feet and the width approximately 20 feet. Beyond this, for a space of about 500 feet, the embankment was just perceptible; the remaining portion, ex-



FIGURE 2

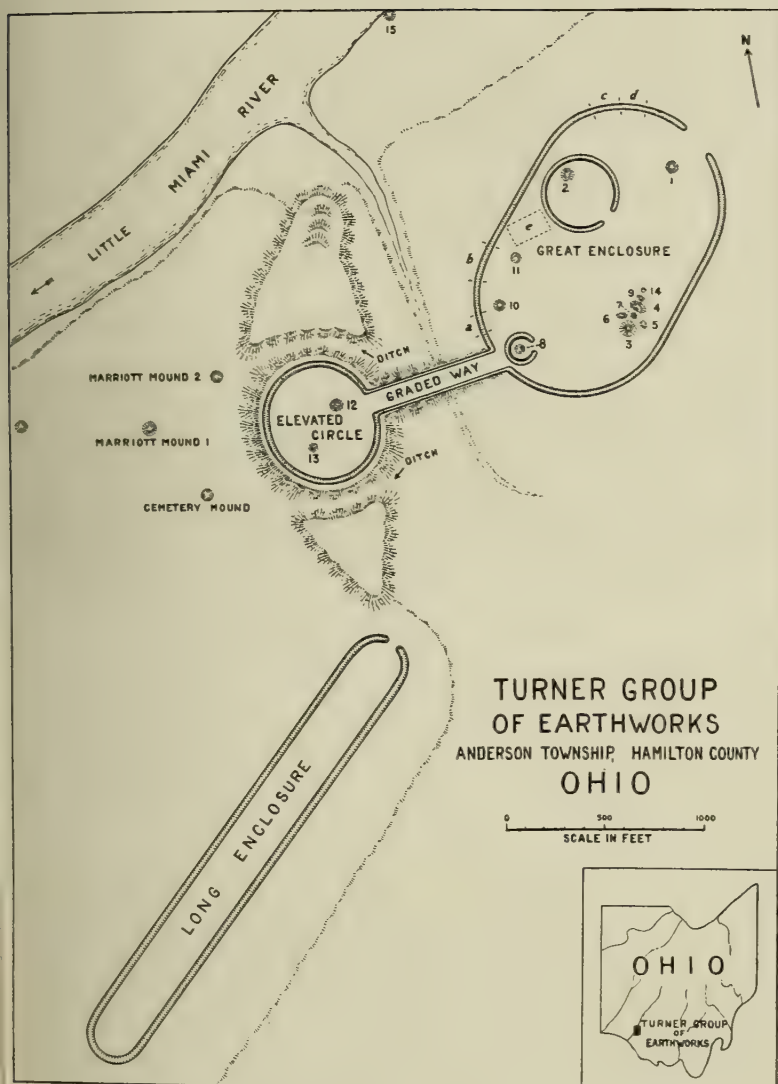
Model of the Turner Group, looking northwest.

tending to the northeastern gateway, was about 1 foot high and 25 feet wide.

The southeastern half of the embankment was nearly obliterated except near the western end, where it rose to a height of about three feet, but its outline could be traced for practically its entire length by the dark color of the soil.

Like numerous other similar embankments in southern Ohio there seems to have been no accompanying trench upon either side. The embankment was low, and while it may have been somewhat reduced by cultivation, it probably never was much higher than when first noted by Whittlesey. Hoping to throw some light upon its origin, it was decided to carry trenches through it at certain points.

Trench A. Just north of the southwestern opening at the foot of the graded way, a portion of the embankment was removed, in 1889, by digging a trench 100 feet long and 50 feet wide, at a,



Plan of the Turner Group of Earthworks from the survey by D. S. and J. A. Hosbrook, made for the Peabody Museum in 1887.

plate 1. Mr. M. A. Saville had charge of this work for the Museum. The trench was carried into the hard-pan, which lay at an average depth of $2\frac{1}{2}$ feet below the surface. Its sides extended somewhat beyond the edges of the embankment.

Within this excavation were found thirty-seven post-holes, several small ash-beds and pits, six altars, and a large hearth of flat limestones. Their distribution is shown in figure 3.



FIGURE 3

Plan of Trench a, embankment of the Great Enclosure.

The post-holes were 3 to 12 inches in diameter. The following table shows the number of each size measured:

Number of post-holes.....	1	1	0	4	6	4	6	4	0	7
Diameter of post-holes in inches	3	4	5	6	7	8	9	10	11	12

With a few exceptions, these were not found until a depth of nearly 30 inches was reached. They extended from 10 inches to 3 feet beneath this level and into the hard-pan, the majority being 18 to 24 inches deep. Nearly all were filled with dark earth mixed with ashes and charcoal.

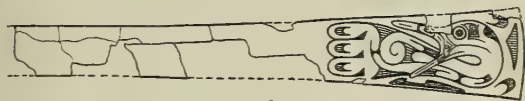
Several small ash-beds of various sizes were encountered, 9 to 30 inches below the surface, most of them lying at a depth of about 30 inches. Some of them may have been post-holes filled with ashes.

A few small pits occurred also, filled with black soil mixed with charcoal, ashes, potsherds, animal bones, and an occasional fragment of a flaked knife. These were probably small abandoned cache-pits.

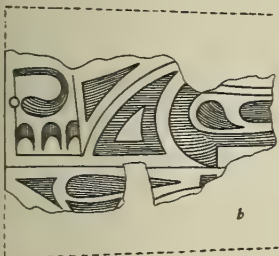
A large hearth, roughly triangular in form, was found 6 inches beneath the surface. It was made of flat limestones, many of which showed contact with fire. This hearth was similar to others found in different sections of the embankment. The soil about the hearth was black, and mixed with ashes.

The altars were mostly small, and only 6 to 7 inches below the surface. Altar 1 measured 36 by 25 inches, and like the other altars of this group was made of clay. The cavity was 4 inches deep, and the slope of its sides was 10 inches. The clay at its center was burned to a depth of 10 inches. The corners were rounded, and projected as shown in the plan. Mixed with the ashes in the basin were the perforated canine teeth of small mammals, beads of bone and copper, copper-covered buttons, fragments of copper ear-ornaments, perforated fossil teeth of the shark, a flint knife blade, pieces of mica, fragments of carved bones, and various other articles, all more or less injured by contact with fire. The most remarkable of these objects are the carved bones shown in plate 2. The bone spatula with the incised drawing of a bird, illustrated in a, is perhaps the most refined design yet taken from the mounds. The lines of this carving were originally filled with red pigment.

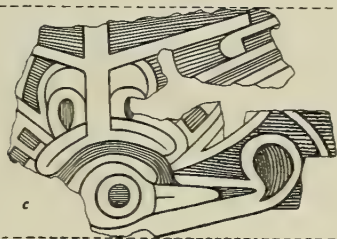
All of the carved bones were broken and badly injured by burning, but the upper part of one of the most interesting, which was probably made from a human ulna, has been pieced together. This is shown in h. The principal part of the design appears developed in g. It represents the head of an animal with upright ears, between which is an oval figure. This head, separated from the rest of the design, is shown somewhat reduced in d. By splitting the drawing g, lengthwise through its center and joining the outer edges, i is produced, with the smaller head having cross-hatched teeth appearing in the center. This head, also reduced in size, is shown in f. By reversing the drawing i, the horned head, e, appears as the principal figure. The lower part of this carved bone which was destroyed, evidently had similar complicated patterns.



a



b



c



d



e



f



g



h



i

Incised designs upon bone, from Altar 1, Trench a, embankment of the Great Enclosure: a, Spatula-like object made from rib bone; b, c, Design upon fragments of human femur; h, Portion of human ulna; g, i, Developed design upon h; d, e, f, Animal heads, somewhat reduced, which appear in g, h, i; The design e, is seen when i is reversed. (About 2/5.)

The designs upon fragments of another carved bone, probably a portion of human femur are shown developed in b and c. Unfortunately, only a small part of this specimen could be restored, and not enough of the design remains to be intelligible. Like most of these curious carvings, the complete design represents a conventionalized animal form, probably a bird. Two other examples of this class of work from the central altar of mound 3 are shown on pages 57 and 58. Interesting specimens from other mound groups are figured elsewhere.¹

Most of the carvings are upon human bones. One of the specimens from the Hopewell Group, Ross County, shows the figure of an ocelot incised upon one of the long bones of a large bird. Other examples are cut in antler and shell. Fragments of wooden bowls from the Hopewell Group show the same type of decoration. A stone pipe bowl from the Liberty Group, representing a human head, has the face ornamented with this form of decoration, indicating its use in face and body painting. This highly specialized style of ornamentation was doubtless applied to many other common objects.

This peculiar art development was no doubt as characteristic of the great earthwork area as that of the Northwest Coast tribes is of the region which they inhabit. It is probably true that in no section of America north of Mexico had decorative art reached a higher plane than in southern Ohio.

Altar 2 was intact but contained no artifacts. Altars 3, 4, and 6 had been broken or disturbed by the plow.

Altar 5 was in good condition and is shown in plate 9, a. This is now in the Cincinnati Museum. Its cavity was filled with ashes, charcoal, and burnt bone. Among the ashes were found a perforated fossil tooth of a shark, seventeen shell beads of various forms and sizes, four pearl beads, a broken point, and fragments of bone and antler implements.

It seems probable that a building of some kind occupied the space uncovered by this trench, possibly one of a series of earth-covered structures originally forming the enclosure.

We are apt to associate earth-covered buildings with the Arikara, Pawnee, Mandan, or other western and northern tribes, forgetting

¹ C. C. Willoughby, *The Art of the Great Earthwork Builders of Ohio*, Holmes Anniversary Volume, Washington, 1916.

that in early historic times it was the custom among many of the southern and central Indians to cover the walls (and in some instances the roof also) of their variously shaped buildings with clay or earth. The Caddo, Taensa, Natchez, Choctaw, and Biloxi are among the tribes who followed this custom.

It was suggested by Lewis H. Morgan¹ many years ago that long earth-covered communal houses may have occupied some of the embankments of the great earthwork enclosures of southern Ohio.

The excavation of portions of this low embankment seems to

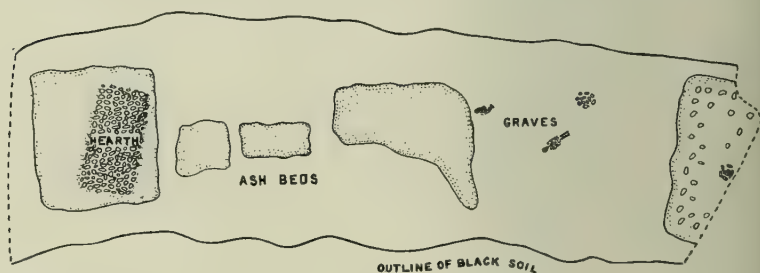


FIGURE 4

Plan of Trench c, embankment of the Great Enclosure.

indicate that possibly in this instance the enclosure may originally have been formed of oblong earth-covered buildings, erected upon the natural surface of the ground. It is possible that they may have been arranged in clan groups, something after the manner of the great tribal circles of some of the Plains Indians. As the buildings decayed, the earth covering and other debris would be added to the dark earth and ashes surrounding and covering the hearths, some of which were found undisturbed during the excavations. This is offered as a suggestion only, and may be worth considering in future explorations of similar earthworks.

Trench B. To the north of trench a, the embankment apparently had been reduced in height for a space of about 150 feet. This part was not explored. To the northeast of this leveled portion, a second trench, plate 1, b, the same width of the first, was dug

¹ L. H. Morgan, *Houses and House-Life of the American Aborigines*, Contributions to North American Ethnology, Vol. IV, pp. 207-214.

for a distance of 200 feet. Nothing of special interest was encountered in or beneath the embankment at this point. One small altar containing no artifacts was unearthed near its southwestern end, and seventeen post-holes, irregularly arranged, two or three ash-pits or ash-beds, and the remains of a child, were found at intervals.

Trench C. In 1890 the exploration of the embankment at c, plate 1, was continued under the charge of Mr. Saville. Several ash-beds, an undisturbed hearth of flat limestones, and four shallow graves were unearthed. The positions of these are shown in the

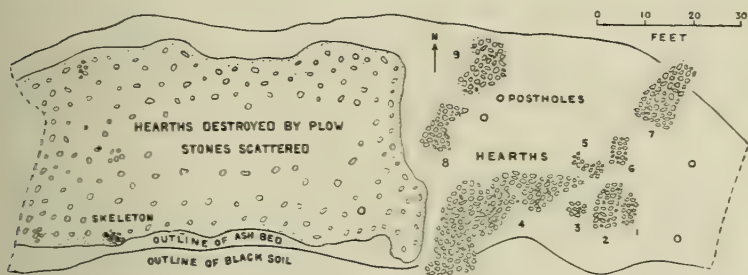


FIGURE 5

Plan of Trench d, embankment of the Great Enclosure.

plan, figure 4. The composition of the embankment at this point was similar to that shown by trench d.

Trench D. During the same season, Mr. Ernest Volk also explored 150 feet of the embankment at the point just east of trench c. The results are indicated in figure 5.

Several hearths were found in the eastern half of the excavation. These consisted of one to three layers of limestones which had in most cases been placed on a thin layer of surface soil overlying a natural stratum of clay. Mixed with the hearth stones and covering their surface were ashes, charcoal, and black soil. Many of the stones were partially, and a few wholly, calcined by the heat. The deepest of these hearths was only 14 inches beneath the surface, but none of them had been disturbed by plowing. The hearths in the western half of the trench, however, were nearer the surface, and the stones had been scattered by the plow throughout this area. Mixed with the ashes and black soil in both sec-

tions were potsherds, flint chips, fragments of mica, broken bone, and flint implements, broken and burnt bones of various animals, and also a fragment of a terra-cotta figure similar to those from the altar of mound 4.

Six post-holes were found, symmetrically arranged. The positions of these are shown by the small circles in the plan. They

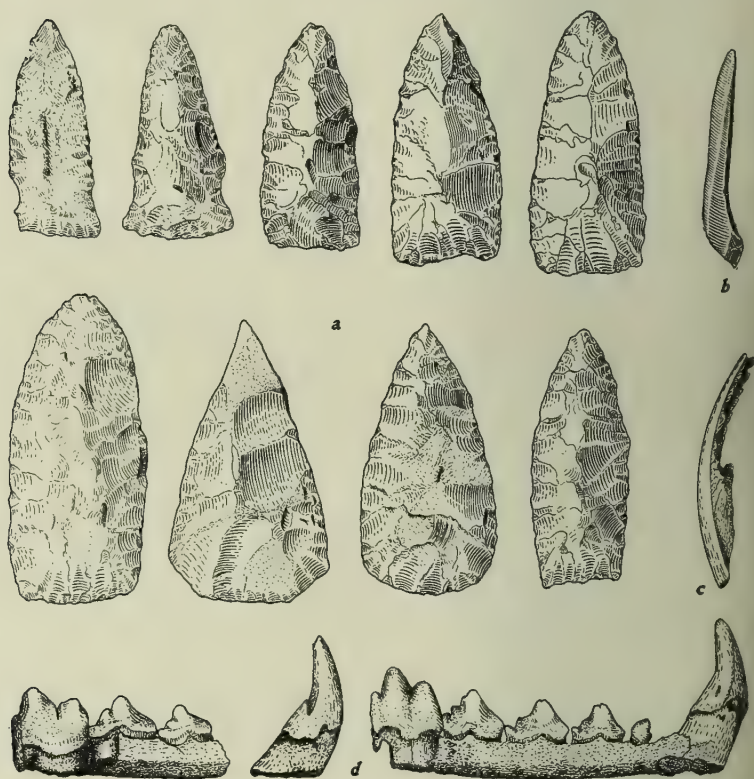


FIGURE 6

Objects found with skeleton in Trench d: a, Chipped knives; b, Flaked knife; c, Beaver tooth chisel; d, Cut jaw of wolf. (About 1/2.)

were about 3 feet in depth. The smallest was 7 inches, and the largest was 12 inches in diameter. They may have formed a part of the supporting timbers of a large structure. Near the southern edge of the black soil, in the western part of the trench, portions of

a skeleton were found which had apparently been disturbed by cultivation. Only a few fragments of the skull were unearthed, and these showed contact with fire. With the bones were nine undisturbed flint knives lying together, figure 6, a. Seven were leaf-shaped, and two had shallow side notches. Five of these flint knives were in a row, points to the north. Above these were four others, with points to the south. There were found also with the bones, a flaked knife, b; the cut lower jaw of a gray wolf, d; and a beaver tooth chisel, c.

At the time of the exploration of mound 1, a trench was carried into the embankment just north of its eastern opening. A hearth



FIGURE 7

Elevated Circle and Graded Way, looking nearly west. Mound 12 is shown in the distance to the right of the center.

or stratum of burnt limestones, 6 to 10 inches deep, and about 30 feet wide, formed its base at this point. Dr. Metz writes as follows regarding its composition in the vicinity of this excavation:

The northeastern section of the embankment for a distance of 300 feet was composed of ashes, charcoal, burnt limestone, and earth, in which were innumerable fragments of chipped points, implements, pottery, and burnt bone, also many perfect implements, beads, etc. This part of the embankment was a great place to make surface finds, and many specimens were gathered by collectors.

The Elevated Circle. This is situated on what was originally an oblong elevation or table-land, formed by a detached portion of the first river terrace, about 2-5 of a mile long and 550 feet broad near its center. The central portion of this terrace (see plate 1, and figures 2 and 7) had been made into a circular elevation by

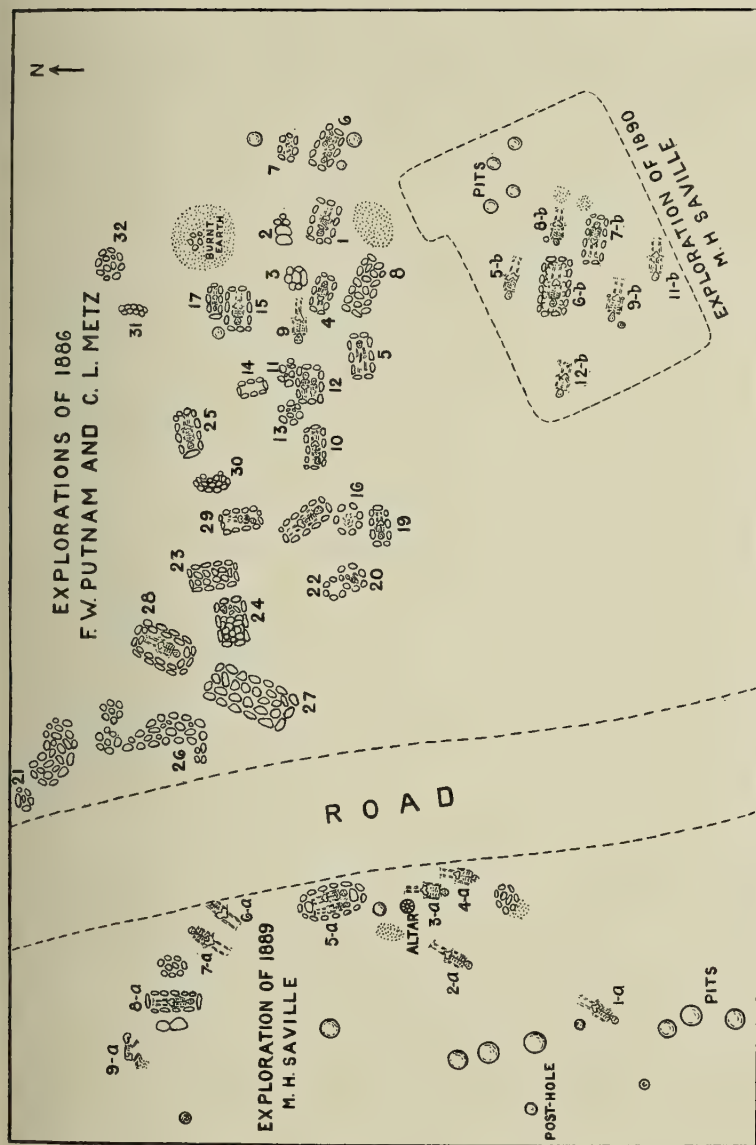
cutting two deep ditches in the form of segments of circles through the hill. According to Whittlesey's measurements, these trenches were 70 to 85 feet broad at the top, and 12 to 18 feet deep. The top of the elevation was 25 to 30 feet above the field of the great enclosure. The greater portion of the earth taken from these great trenches had undoubtedly been used to form the graded way, which connected the elevated circle with the great enclosure. Probably a part of it was also used in the construction of the circular embankment upon the elevation.

The embankment forming the elevated circle was, in Whittlesey's day, about 15 feet across and two feet high. The enclosure formed by this embankment was approximately 482 feet in diameter, north and south, and 485 feet, east and west, and contained two mounds. The space between the circle and the edge of the embankment upon which it was built was about 25 feet wide, with a gradual slope outward.

BURIAL PLACES WITHIN THE GREAT ENCLOSURE

General Description. Upon the northwestern side of the great enclosure at the point marked e, plate 1, is a low ridge, which was about a foot in height above the general level of the field. This ridge had been plowed since 1825. Here Dr. Metz had noticed, in various places, small areas covered with flat river stones, which had been disturbed by plowing. This, in connection with the fact that skeletons had been unearthed when the road leading across the ridge to the river was made, led to the conclusion that it was the site of an ancient cemetery. Explorations were begun by Professor Putnam on September 22, 1886, with the help of two men, and the work was carried on till October 2. During this time graves 1 to 25 were explored. The work was continued in October by Dr. Metz, who opened seven additional graves (26 to 32). The plans and cross-sections are from sketches by these two explorers. In 1889 and 1890, other portions of this burial place were excavated by Mr. Saville, who was then a student with Professor Putnam.

The interments of the uncremated bodies were usually in comparatively shallow graves, many of which were carefully constructed and outlined with flat limestones set upright. In some instances, a wall was laid at the head and foot (see plates 4 and 5).



Burial Place within the Great Enclosure. Its position is shown by the area e, plate 1.

The bottoms of a few of the more carefully made graves were paved with flat stones, and upon this paving the body was extended, usually upon its back. Comparatively few artifacts were found with the skeletons. These, however, were usually of such a nature as to show conclusively that the burials were contemporary with the people who built these mounds and enclosures. The graves were usually filled with earth, and covered with one or more layers of limestones, which in some instances extended beyond the limits of the grave. Other graves were filled with stones. Still others were without the side and end stones. These, however, were usually, but not always, partially or wholly covered with a layer of stones near the surface.

The graves or cineraria containing cremated human remains were usually small excavations outlined, like the larger graves, with flat limestones set upright. They were circular, or in the form of a parallelogram. Occasionally, the ashes and burnt bones of a cremated body were interred in the grave with the ordinary burial. Sometimes elaborate stone cists were constructed for these remains, as in grave 27 (plates 3, and 4, h). Like the large graves, these cineraria were often protected by a layer of stones, at or near the surface. Some of the layers covered much more space than was occupied by the grave itself. At times, the cremated remains were placed in a comparatively shallow excavation, and covered with earth, no stones being used in connection with the burial.

A few burnt spaces and beds of ashes were found in the cemetery where bodies may have been burned, but it seems more probable that most of the cremating took place on the site of one of the large mounds, where evidences of long continued and intense fires were abundant. Only a few artifacts were found with the cremated burials.

Graves Excavated by F. W. Putnam, 1886. *Grave 1.*¹ This contained the skeleton of an adult extended upon its back, head to the west (see plates 3, and 4, e). The grave was outlined with upright limestones. Just north of the skull was a large shell vessel; shell beads were at the neck; a spool-shaped ear-ornament of copper rested in each hand; and near the left tibia were found a

¹ A few of the more important of these graves are described by Professor Putnam in the Peabody Museum Reports, Vol. III, pp. 556-562.

bead, a copper pin, a flint flake, and two pieces of shell. Within the grave, and near the right hand of the skeleton, rested a pile of burnt human bones, about a foot in diameter.

Grave 2. This small grave contained burnt human bones, and was outlined with eleven flat stones. The inside measurements were: length, 22 inches; width, 11 inches; depth, 10 inches (plate 4, d). The grave was covered with two large flat stones, and

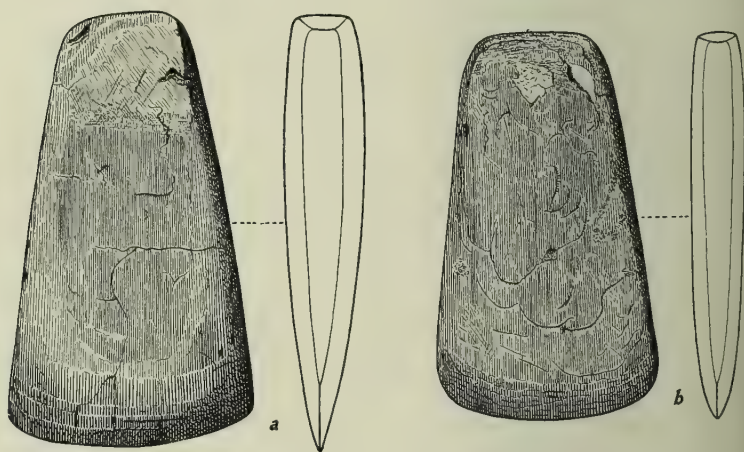


FIGURE 8

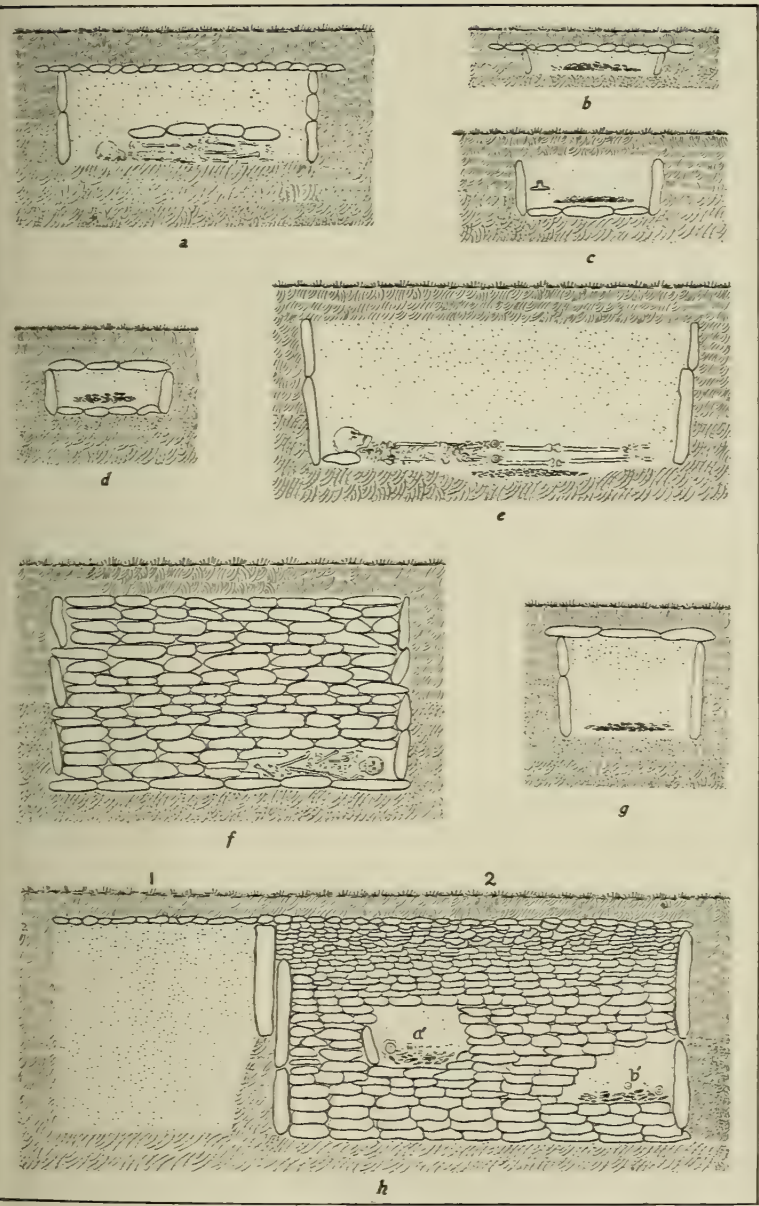
Ceremonial axe blades of cannel coal from Burial Place e, of the Great Enclosure: a, From Grave 12; b, From Grave 8. (1/2.)

several small ones. Two beads and an ornament, all of shell, were found with the bones.

Grave 3. Although covered with stones, and having the general appearance of a grave, this may have been used for another purpose. It was about 4 feet in diameter, and had been dug in the gravel to about the same depth. It was filled with black soil, charcoal, and ashes. It had much the appearance of a cache-pit. No human remains were found in it.

Grave 4. A small grave with stones surrounding it. It contained the extended skeleton of a child, head to the east.

Grave 5. This was $6\frac{1}{2}$ feet long, 33 inches wide, and 20 inches deep, and was outlined with the usual upright stones. Four large flat stones, upon which the body had been placed, nearly covered



Cross-sections of graves containing skeletons or cremated human remains, Burial Place in the Great Enclosure: a, Grave 29; b, Grave 32; c, Grave 7; d, Grave 2; e, Grave 1; f, Grave 24; g, Grave 21; h, Grave 27.

the bottom of the grave. The body was extended, head to the east. With the bones of each hand lay a spool-shaped ear-ornament of copper. At the side of the grave near the left shoulder were two pairs of similar ornaments, and a bone point. At its foot near the southern corner lay a conical stone object, bear teeth ornaments, and a piece of galena. Two of the teeth were inlaid with pearls. Under the large floor-stone near the foot of the grave were several flint flaked knives, and a small copper blade (figure 44, b). Beneath the second floor-stone lay the two discs of a spool-shaped ear-ornament, and a portion of a copper-covered bead. Under the third floor-stone were a copper bead, and a band of thin copper. These objects are shown in plate 6, a.

Grave 6. This was neatly walled, and covered with twenty-one small stones. It contained two skeletons, which are shown in plate 5, b. One extended on its back, skull to the west, and arms lying at full length; left hand over hip, and the right a few inches away from side of hip. The legs had been pushed to one side to make room for the second body, the skull of which was just below the hips of the first. The legs of the second body were somewhat drawn up, extending by the side and partly under the legs of the first. The bodies were both adults, the extended one probably a female, and the other a male. They evidently were interred at the same time.

Grave 7. This is shown beyond grave 6, in plate 5, b. It is surrounded by eleven stones set on edge. Dimensions, 30 by 16 inches. Its bottom was partly covered by seven small stones. It contained burnt human bones, and a much disintegrated tobacco pipe. A cross-section of this grave appears in plate 4, c.

Grave 8. This proved to be a pile of gravel, $9\frac{1}{2}$ feet long by 4 feet wide, carefully covered with many stones, 6 to 12 inches in diameter. The surface soil had been cleared away all about the gravel, leaving it in the form of a grave mound, but there were no edge stones. No skeleton was discovered beneath the gravel. To the east of this grave, at a distance of 3 feet, was the edge of a fireplace, 6 feet in diameter, where the clay overlying the gravel had been burned to a depth of 3 or 4 inches.

Grave 9. Adult skeleton, head to the west. The grave was not outlined with stones. Bits of mica were near the right side.

Grave 10. Considerable gravel, and about thirty stones were over this grave, which contained the skeleton of an adult at a depth of 16 inches from the surface. The skull, which is shown in plate 25, occupied the southwestern corner, and rested upon its left side. A small axe blade of cannel coal (figure 8, b) lay near the right arm in such a position as to indicate that its handle had rested in the hand of the deceased. Within the grave, to the south of the leg bones, was a small circle of upright stones, containing burnt human bones, probably the remains of a cremated body.

Grave 11. A stone-covered grave that had been disturbed by the plow. No bones were found.

Grave 12. This was close to grave 11. It contained two skeletons. The one at the south side was extended, head to the east. The bones of the second skeleton were in a pile. Beside the skull lay a shell ornament, while among the bones a short distance from the skull lay an axe blade of cannel coal (figure 8, a). This bunched skeleton was evidently a secondary burial.

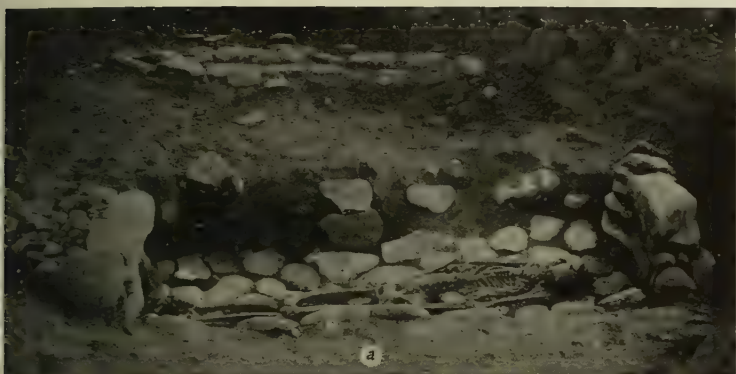
Grave 13. A small grave carefully made, outlined with side stones, and covered with twenty-six small stones; probably for cremated human remains. No bones were found in it.

Grave 14. Of small size, 4 feet long and 1 foot wide. No human remains found.

Grave 15. The end walls of this grave were carefully constructed, but the sides were made by simply placing a row of stones in the clay. The bottom of the grave was not paved, the body being placed upon the natural gravel bed, with its head to the west. The foot bones and skull touched the opposite ends of the grave. A flaked knife lay near the left shoulder. At the neck were two shell beads. A copper band rested upon the breast bone, and a copper ear-ornament lay with the bones of each hand. A number of flaked knives were also found. These specimens are shown at the left in plate 7, a.

Grave 16. This was nearly circular in form, about 4 feet in diameter, and was outlined with twenty-one stones. Resting on the stones at the bottom of the grave were cremated human remains.

Grave 17. Just north of grave 15, their side walls adjoining. The body had been buried in clay. Small stones covered top of grave.



Burial Place in the Great Enclosure: a, Grave 6-b, with Grave 9-b in background; b, Grave 6, with Grave 7 in the background containing cremated remains; c, Grave 8-b.

Grave 18. This had been dug in gravel to the depth of 3 feet, and had over it a pile of gravel 8 inches high, surrounded by small stones set on edge. The skeleton lay with its head to the south-east. Near the right shoulder rested a large shell vessel. Two perforated bear teeth, an ear-ornament of copper, and a small plate of hammered copper were at the neck; an ear-ornament of the usual form had been placed in either hand (plate 6, c). The skull from this grave is shown in plate 26.

Grave 19. Surrounded and covered with stones. Gravel pile over it. Contained skeleton of child.

Grave 20. A small circular grave outlined with upright stones. It contained the skeleton of a child in a flexed position, lying on its left side, facing north. With the remains were a small copper blade, the bone of a turkey, a flaked knife, an axe blade, and four small concretions of curious form, two of which are cup-shaped. These are shown in the group at the right, plate 7, a.

Grave 21. Small, about 2 by 3 feet, and 2 feet in depth. Outlined and covered with stones. It contained burnt human bones, and fragments of a thin copper ornament (plate 4, g).

Grave 22. This had been partially destroyed by the plow. It was the small stone-covered grave of a child.

Grave 23. An area 7 feet long and 4 feet wide, covered with flat stones. This had been dug to a depth of 4 feet, and filled with loose gravel and mixed earth. No human remains were found.

Grave 24. This proved to be nearly a duplicate in size of grave 23. Unlike the latter, however, its bottom was paved with forty-nine flat river stones, 6 to 12 inches in diameter. In the eastern half of the grave, fragments of a skeleton were found resting on the pavement, the skull against the northern bank. Two flint knives and a few potsherds were taken from the grave. Over the bones was a pile of about three hundred river stones, 6 to 18 inches in diameter, completely filling the grave (plate 4, f). Mixed with the stones was loose black earth, evidently the result of infiltration.

Grave 25. Outlined with flat limestones. Skeleton extended on back with head to the west. Several flint flakes rested on the right scapula, which was much decayed.

Cache-pits and Post-holes. To the northeast of grave 21, a stone-covered pit was located, which had been dug to the depth of 3 feet in disturbed earth to the hard gravel. No human bones were

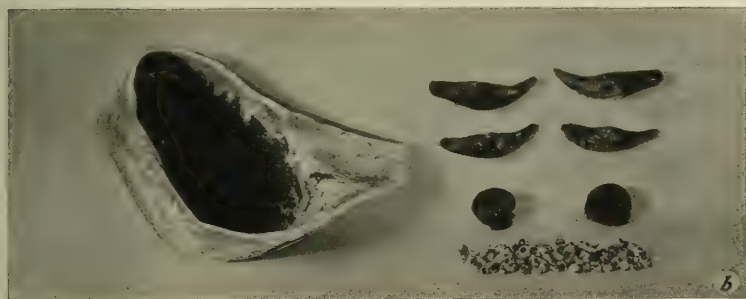
found, only a few potsherds and bones of animals. In addition to the above, Professor Putnam found a small number of post-holes, burnt areas, and what appear to be cache-pits, which are located upon the plan.

Grave 25, explored October 2, was the last one opened by Professor Putnam, in this cemetery. The work was continued during a portion of the month by Dr. Metz, who explored graves 26 to 32. These were in the northern portion of this cemetery. The following account is from the notes of Dr. Metz.

Graves Excavated by C. L. Metz, 1886. *Grave 26.* An irregular area covered with flat stones, $15\frac{1}{2}$ feet in length, and 5 feet in width at its widest point. Beneath the stones a pit 9 feet long and 4 feet wide, had been dug to a depth of 3 feet. This contained black soil, sand, and gravel. On the bottom near its center lay a piece of mica; near its northern end a post-hole, 10 inches in diameter and 19 inches deep, had been sunk beneath the level of the floor. No human remains were found.

Grave 27. This was a stone-covered space, 12 feet long and 6 feet wide. On removing the stones, two pits were discovered (see longitudinal-section, plate 4, h). Pit 1 was 4 feet wide, and had been dug to the same depth. It contained dark earth, a few animal remains, and burnt stones. Pit 2 was filled with stones, as shown in the drawing. A little north of the center, pit 2, was a cist (a'), 18 inches long and 12 inches high, containing fragments of human bones; and against a portion of the temporal bone rested one-half of a copper ear-ornament. Shell beads were also found with the bones. At the southern end of the pit, and near its bottom, a second cist (b') was discovered, containing cremated human bones and the remains of a pair of copper ear-ornaments. There were no indications that the burning of the bodies had been carried on in the pit. The cremating had evidently taken place elsewhere, and the ashes and partially burnt bones placed in the tomb made to receive them.

Grave 28. This had been dug to a depth of little more than 3 feet, and measured 6 feet long by 4 feet wide. The stone-covered area over the grave was 10 feet long by $4\frac{1}{2}$ feet wide. These stones were covered to a depth of 9 inches by surface soil. The grave contained the extended skeleton of an adult, head to the south-west. No artifacts were found with it.



Artifacts found with human remains: a, From Grave 5; b, With Skeleton d, Mound 12;
c, From Grave 18; d, From place of cremation (10), Mound 3. (1/5.)

Grave 29. Sides and ends lined with upright stones. Adult skeleton, placed face downward, legs flexed on thighs. Bones badly broken by four large stones which lay over the skeleton. The stones covering the grave extended 6 to 8 inches beyond the edge of the excavation (plate 4, a).

Grave 30. A crescent-shaped arc of stones, 5 feet long and 1 to 2 feet wide, under which was a pit 2 feet deep and 8 inches wide, containing black soil and ashes, a fragment of unio shell, and a few animal bones. No human remains, recognized as such, were found.

Grave 31. A space 3 feet long and 12 inches wide, covered with the usual flat stones. Beneath this was a pit, 2 feet long, 8 inches wide, and $3\frac{1}{2}$ feet deep. At its bottom was about a foot of white ashes containing a few fragments of animal bones; above the ashes was a stratum of gravel, the remainder of the pit being filled with black soil.

Grave 32. An oval stone-covered area, 4 feet long and 3 feet wide, under which was a grave in the form of a parallelogram, 30 inches long, 24 inches broad, and 6 inches deep. This was outlined with flat limestones. It contained burnt human bones covered with a layer of sand and ashes, in which were found a long implement of bone, and several awls and needles of the same material (plate 4, b).

Graves Excavated by M. H. Saville, 1889-90. In connection with other work for the Museum at this group of mounds, in 1889, Mr. Saville explored the small area of this burial place lying to the west of the roadway (see plate 3).

Grave 1-a. The principal burial in this grave lay 2 feet beneath the surface, head to the southwest. A large busycon shell vessel rested near the left side of the skull, and near the left shoulder were several flaked knives. On the upper part of the breast lay a copper band, 3 inches long and 2 inches wide, with the sides bent over. This was similar to the bent copper bands from graves 5 and 15, although somewhat larger. The bones of a second skeleton were scattered over the lower half of the first. Its pelvis was in three pieces; its skull lay near its feet bones, while the lower jaw rested a foot from it. The earth covering the upper portion of the first skeleton had been burned; and about a foot above the head and shoulders, and the same distance below the surface, was a

bed of burnt human bones, 12 inches in diameter, and an inch thick. A layer of flat limestones covered this cremated burial.

Grave 2-a. Beneath a layer of burnt earth mixed with ashes, 14 inches from the surface, was a much decayed skeleton, head to the southwest. No artifacts were found with it.

Grave 3-a. Covering this interment was a layer of limestones. The body had been placed with the head to the south. It lay 15 inches from the surface. Near the left side of the pelvis were the remains of a large shell vessel. Near the west side of this grave was a small circular altar-like structure of burnt clay, 21 inches across, with a basin 12 inches in diameter and 4 inches deep, containing mixed soil and charcoal. This altar was nearly 4 feet below the surface.

Grave 4-a. This contained the skeleton of a child. It lay with head to the south, and near the top of the skull was a fragmentary pottery vessel.

Grave 5-a. One foot beneath the surface, a layer of limestones was uncovered. On removing these stones, a grave extending 9 feet north and south was found. It was outlined with flat stones set upright, and was 4 feet 8 inches wide at the center, and 3 feet wide at the ends. Just within the upright lining stones, at either end, lay a large limestone slab. This carefully constructed grave contained two adult skeletons, extended heads to the south. The skull of the skeleton to the west had been destroyed by the digging of a hole for a fence post. Some of the fragments which remained were impregnated with copper salts, showing that some article of copper, small pieces of which were found, had been deposited in contact with it. The skeleton in the eastern portion of the grave was lying partly upon its left side. In each hand rested a spool-shaped ear-ornament of copper. At the feet of each body a busycon shell vessel had been placed. Between the adult skeletons and near the right shoulder of the first, were the remains of a child, a shell vessel, and several small pieces of copper. Between the lower limbs of the adult skeletons were a considerable quantity of human remains, two pieces of galena, and a thick piece of mica, which had also been subjected to the action of fire.

Grave 6-a. This contained only a part of the skeleton, the skull and bones of the upper part of body having been washed out of the embankment formed by the roadway.

Grave 7-a. An extended burial, head to the north. Bones much decayed. No artifacts.

Grave 8-a. A much decayed skeleton, 2 feet from the surface, head a little west of south. Large limestones were at the head and foot of the grave which was covered with a stone layer. Twelve inches west from the edge of the grave were two large stone slabs beneath which, at a depth of 2 feet, was a mass of burnt human bones, 4 inches in depth, occupying a space 3 feet long and $1\frac{1}{2}$ feet wide.

Grave 9-a. This contained a flexed skeleton, lying upon its left side, head to the east. Near the feet and leg bones was a bed of cremated human remains, 2 feet from the surface.

Cache-pits and Other Remains. A few feet southeast of grave 2-a, and 6 inches below the surface, a bed of flat limestones, 4 feet long and 2 feet wide, was found. At its western end, and 10 inches from the surface, was a mass of burnt bone, presumably human, in small fragments.

A short distance to the west of grave 3-a, and the circular altar, was a hearth or burnt space, 3 feet long by 2 feet wide. To the east of grave 8-a was a stone-covered pit containing large masses of burnt clay and charcoal.

A few cache-pits and post-holes occurred, mostly to the south-west of these burials. The pits were usually 4 to 6 feet deep, and 30 to 40 inches in diameter. They contained charcoal, ashes, burnt clay, potsherds, and animal bones. The post-holes were usually about 10 inches in diameter, and 18 to 24 inches deep.

Work was continued in this cemetery by Mr. Saville in 1890 in the southeastern portion, within the area enclosed by broken lines.

Grave 5-b. This burial was less than a foot from the surface, and was extended upon the back. Near the right shoulder was a sandstone pipe of unusual form, figure 11, b. Near the left elbow was a small pile of stones, and near the right foot, a flaked knife. If stones originally covered the grave, they were probably disturbed by the plow, and removed.

Grave 6-b. This contained a single extended skeleton, upon a pavement of flat stones (plate 5, a). The tops of the well-made walls at the head and foot were 12 inches from the surface, and the sides of the grave were outlined with flat stones set upright. In the right hand of the skeleton rested a piece of galena, and the

worked lower jaw of a bear. In the left hand, two small pieces of galena had been placed. The stones forming the foot of the grave lay over a filled pit of unusual extent. This was about 3 feet in diameter, and had been excavated to a depth of 10 feet. It was filled with burnt clay and charcoal, mixed with a few animal bones and flaked stones. Small piles of stones, five or six in a pile, were found at various depths.

Grave 7-b. The body was extended, head to the southeast, and lay about 12 inches beneath the surface. The grave was not paved, but was outlined with the usual flat stones set on edge. Near the left tibia, fourteen unperforated canine teeth of the bear were lying in a pile, together with a piece of much decayed worked antler, evidently the handle of the flint knife found near it. There was also a small rudely chipped knife, probably unfinished.

Grave 8-b. This was without the outline of upright stones, and contained the skeleton of a child, 2 feet 9 inches beneath the surface. Near the skull rested a large busycon shell food vessel, within which was a large unio shell spoon. A similar spoon and one valve of a unio shell, unworked, lay near the vessel. This burial is shown in plate 5, c.

Grave 9-b. A few feet to the south of grave 6-b, excavations revealed a layer of stones a few inches beneath the surface. This is shown in the background in a, plate 5. Upon removing this layer, other stones were found, and nearly a cart-load was taken out. Three inches under the lower layer of stones, and 3 feet 9 inches from the surface, was the extended skeleton of an adult male. Three inches from the right side of the skull lay a pottery vessel, crushed by the weight of the stones above. Within it was a unio shell spoon. Against the pot rested a large busycon shell vessel, and against this was a sheet of mica. Among the bones of the right hand were two ear-ornaments of copper, and in the left hand two similar but less well-preserved ornaments. On the left side, between the arm bones and ribs, were scattered nineteen small shell beads, and six bone awls or pins with points toward the shoulder. Resting on the awls were a flaked knife of chalcedony, and a copper pin (plate 7, c).

Grave 10-b. This was small, and contained cremated human remains and a copper pin or awl. About 3 feet to the southwest was another similar interment, without artifacts.



a, Artifacts from Graves 15 (left) and 20; b, From Grave 16, Mound 1; c, From Grave 9-b; d, Cremated human bones, place of cremation, Mound 3. (1/6.)

Grave 11-b. The skeleton was extended 21 inches beneath the surface, head to the west. The grave was neither outlined nor covered with stones. A small quantity of mica lay near the left femur. The bones were much decayed.

Grave 12-b. The most westerly of the graves in this group. The skeleton lay 3 feet beneath the surface under a few limestones. Some of the bones were disarranged. Both bones of each lower leg were broken squarely across at about a third of their length below the knee. The extremities of the right leg lay nearly at right angles across the right femur just below its center, while those of the left extended diagonally downward from near the center of the left femur. The foot bones occupied their normal position in relation to the lower portions of each tibia and fibula. The skull was twisted from its natural position, its right side resting upon the upper portion of the right humerus. Near the skull lay a busycon

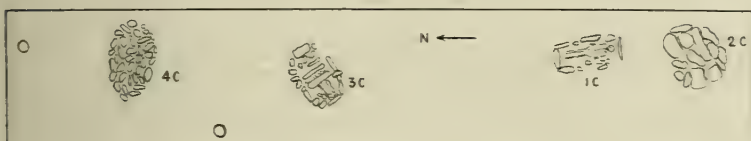


FIGURE 9
Graves north of Mound 14.

shell vessel, and an antler needle 16 inches long and $\frac{3}{8}$ of an inch in diameter.

Cache-pits. Five pits occupied the positions shown in the plan. Most of these were 4 to 6 feet deep, and about 30 inches in diameter at the top. From the surface downward, the contents of pit 1 were as follows: 6 inches of black soil; 33 inches of clay; 9 inches of gravel; and 27 inches of charcoal, burnt clay, and pieces of bone and chert. The contents of the other pits were similar.

Graves Excavated by Ernest Volk, 1905. To the northeast of the group of seven altar-mounds in the southeastern part of the great enclosure, a few graves were explored by Mr. Volk for the Museum in 1905. These were similar to the burials in the north-western portion of the enclosure already described. The top-soil to the northeast of the altar-mounds was 12 inches deep. Beneath this, and covering the graves, was a 6-inch layer of sand and gravel.

The pebbles in the gravel were very small, and the layer was apparently not a natural deposit. This stratum spread out northward from the base of mound 14 for about 50 feet.

Grave 1-c. This was found just beneath the layer of sand and gravel. It was outlined with a few flat stones set upright (figure 9, 1c). The burial was of an adult, lying upon its back, head to the

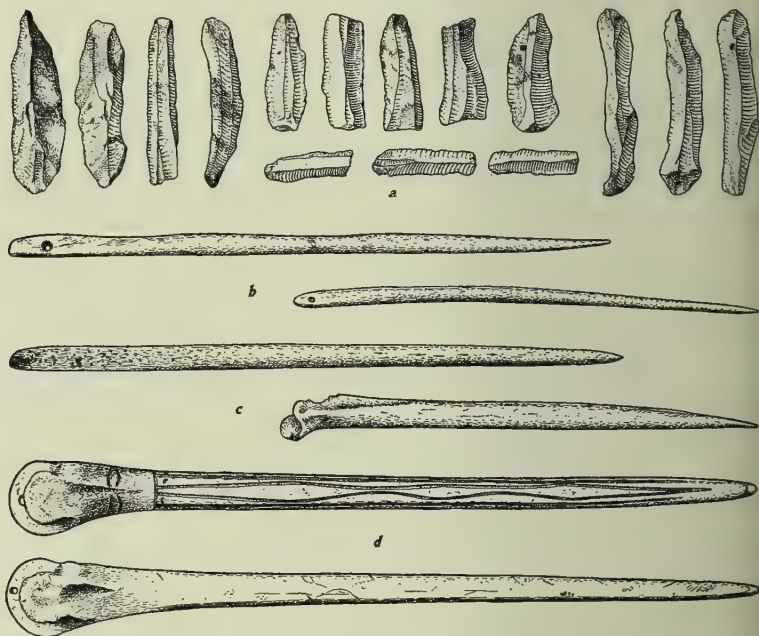


FIGURE 10

Objects from Grave 1-c, near Mound 14: Flaked knives, bone needles and bodkins. (1/2.)

south, at a depth of 2 feet. Near the neck were a number of discoidal shell beads, and at the wrists the remains of bracelets of similar beads and small perforated shells. Near the left shoulder were fifteen flaked knives in a heap, which had probably been deposited in a bag or similar receptacle. Not far from these were two needles and two perforators of bone, and a pile of perforated marginella shells. Just beyond were two large bone bodkins, one of which was decorated, lying with their heads together, the points in opposite directions. Both were perforated for suspension

(figure 10). Near the left tibia were fragments of what was probably a shell spoon. Upon the right side of the skeleton, about half-way between the shoulder and elbow, and at a distance of one foot, was a small heap of burnt bones of an adult. To one side and beneath one of the stones outlining the grave were numerous unburnt bones of children.

Grave 2-c. A short distance to the south of grave 1-c was found a circular layer of eleven stones, just below the reach of the plow.

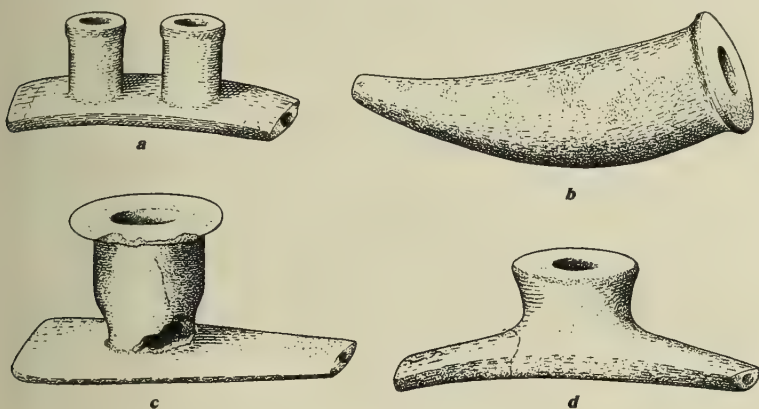


FIGURE 11

Tobacco pipes: a, From grave beneath the base of Mound 1; b, Grave 5-b, Burial Place e, Great Enclosure; c, Grave in embankment of Elevated Circle; d, Grave 2-c, north of Mound 14. (1/3.)

The diameter of the circle was a little less than 5 feet. The following description is from Mr. Volk's report:

Took the top slab off and found under it several pieces of crania of children. On the northeast, among the slabs and touching them were fragments of bones of infants. On the east, between the small stones below the large slab were also fragments of small human crania. One half of the skull of a child lay bowl up, and another alongside of this, bowl down. Other parts of children's bones were lying among the stones. Under the portion of skull which lay bowl down, I found a fragment of tibia, two fragments of rib, and a piece of breast bone, and near the skull fragment, a portion of a jaw with teeth.

On removing the slab from the northwest side of the circle, I found charcoal and ashes. Under the west slab was a small pit, 18 inches in diameter, and 8 inches in depth, which was filled with burnt and calcined human bones, apparently of an adult or adults, and also a sandstone pipe [figure 11, d], and a shell bead. Just south of the pit were more fragments of the bones of infants. None of the infant bones from this grave were burned.

Grave 3-c. A double grave outlined with limestones set on edge, and covered with flat stones of various sizes. The grave was divided by an oblong stone of symmetrical shape placed across its center. In the eastern half were portions of the skull and humerus of an adult, and upon either side of the skull lay a busycon shell vessel, and the remains of two unio shells, evidently used for spoons.

The western half of the grave contained a few pieces of human bones. Upon removing the long slab dividing the grave, fragments of the bones of children and adults mixed with earth were discovered.

A short distance to the north of this grave, a stone-covered space (4, c) was found, $7\frac{1}{2}$ feet long and 3 feet wide. No burials



FIGURE 12. — Cross-section of Mound 1: 1, Clay; 2, Yellow clay; 3, Mottled clay, sand ashes and black earth; 8, White ashes; 9, Altar with enclosed skeleton; 10, Fireplace with

were encountered beneath the stones. This seems to be analogous to the stone-covered pits, containing no skeleton, found in the cemetery in the northwestern part of the enclosure, which, if not actually graves, must be closely related to them.

Mr. Volk found also one or two additional burials and stone-covered spaces while excavating in the great enclosure, near the roadway to the west of the earth circle surrounding mound 2.

THE MOUNDS AND THEIR CONTENTS

Mound 1. This stood near the northeastern entrance to the main enclosure. It was 56 feet in diameter, measuring from the outer edge of the low stone wall which outlined its base, and a little less than 5 feet in elevation. The wall was about 2 feet in width, and a foot in height. The general construction of the earthwork is shown in the cross-section, figure 12. Only one

original burial was found above the concrete layer which formed the base of the mound. All others, with the exception of intrusive interments, occurred just below this layer.

The term concrete is used throughout this paper to designate a layer, usually about 2 to 4 inches thick, composed principally of gravel, coarse sand, and ashes, cemented into a compact mass. In some instances, traces of what appears to be iron are seen; but the principal cementing material is probably lime, produced by the accidental reduction of limestones in the great fires. The lime thus produced, mixed naturally with the wood ashes, probably formed the cementing ingredient. In one of the limestone hearths of trench d, in the great embankment, Mr. Volk found



and ashes; 4, Dark earth; 5, Brown burnt clay; 6, Concrete; 7, Alternate layers of pottery vessels; 11, Small altar; 12, 13, Graves beneath concrete layer; 14, Intrusive burials.

many of the stones partly, and a few wholly, reduced to lime by the intense heat.

The work of exploration was begun in 1882, when Professor Putnam and Dr. Metz cut five trenches from its periphery through to the center, where a fireplace, 7 feet in diameter, was found containing four pottery vessels (figure 13). Mixed with the ashes were charcoal, flint flakes, charred corn and corn-cobs. The pottery vessels are illustrated in plates 22, g, h, i, and 23. At the bottom of the trench in the southwestern portion of the mound, a single layer of round flat river stones was found, 18 inches wide, extending 4 feet to the northwest (number 15 of figure 13). The stones were carefully placed, and overlapped each other like roof tiles. Beneath the stones was a layer of ashes and burnt earth, the ashes 6 inches and the burnt earth 4 inches deep. Fragments of what Dr. Metz thought to be burnt human bones were found on the burnt earth.

In 1886, the work of exploration was again taken up, and completed. The following is from the notebook of Dr. Metz:

Grave 1 was under the layer of concrete, length 8 feet 4 inches, width 4 feet 8 inches. The grave contained 18 inches of gravel resting on a bed of bluish ashes, $1\frac{1}{2}$ inches thick. In these blue ashes were two lines of white ashes, 2 inches wide, and extending the full length of the grave. In these white ashes, small hard concretions, similar to the white substance taken from the flues under mound 3, were found. Beneath the ashes was a layer of fine gravel and sand. At the eastern end of the grave, and below the ashes, a stone about a foot long stood upright. At the opposite end were five similar stones, with their upper ends just protruding through the ashes. A few inches from the first stone lay the head of a well-preserved skeleton of an adult female. At its knees rested a unio shell spoon. To the right was the skeleton of a child. Near its head lay three bone awls, a bundle of bone needles, and several flaked knives of flint. At the left foot was a unio shell filled with a red substance. Several flaked knives, some broken, were also found near the shell.

A little to the west of this double burial, and above the layer of concrete forming the base of the mound, was a mass of clay burned to a red color, having the form of a truncated pyramid (number 9, figures 12 and 13). It was 12 inches high, its base and top measuring 5 feet and 3 feet respectively.

Upon this lay a skeleton in flexed position, face downward. Around the skeleton and covering it was a structure of worked clay, 5 to 7 inches thick. The space between the bones and clay covering was filled with fine soft black earth, from which the bones were easily separated. Fragments of a few bone awls were taken from the grave, one being finely ornamented.

To the southeast of this altar-like structure, and beneath the concrete layer, at a depth of nearly 7 feet from the surface of the mound, another grave was found, containing a single skeleton (number 12). It lay in a horizontal position, head to the northwest, the left arm flexed on the chest, and the right arm flexed back parallel to the trunk.

Still farther to the southeast, at a distance of about 4 feet, and also beneath the concrete layer, lay a skeleton in a horizontal position, head to the southeast (number 13). No artifacts were found in either of these graves.

Twelve inches west from the central stake, and beneath the concrete layer, was a grave containing three skeletons of adults (number 16). The following description is by Dr. Metz:

The grave was 8 feet long and $4\frac{1}{2}$ feet wide, and extended northwest and southeast. Depth from the surface of the mound 6 feet. The three crania were in a line, and about a foot apart. At the feet of the skeleton at the southern side of the grave, lay a large marine shell vessel, several shell ornaments, and large pearls; at the left knee rested a shell spoon; and gripped in the left hand was a marine shell, cut and perforated, probably a drinking vessel [plate 7, b].

Nothing was found with the skeleton in the middle of the grave. With the third skeleton occupying the northern side of the grave were more than 200

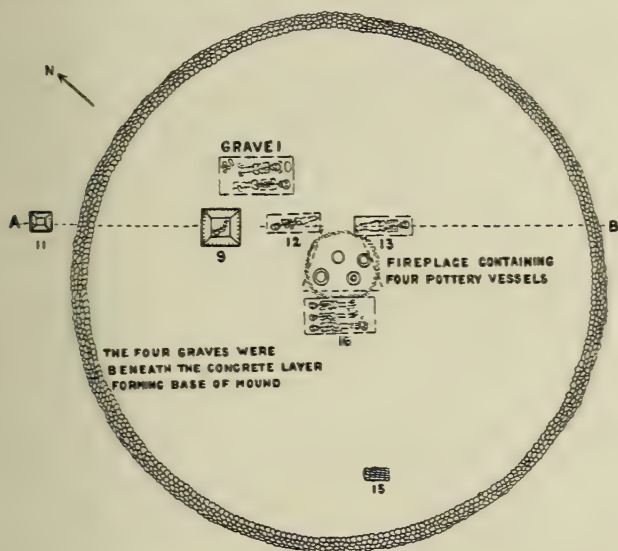


FIGURE 13

Plan of Mound 1: 9, Altar with enclosed skeleton; 11, Small altar; 1, 12, 13, 16, Graves beneath concrete; 15, Stone-covered space.

pearl beads, and a stone pipe with 2 bowls. The latter lay near the right knee, and the former were found by the side of the right tibia. [The pipe is illustrated in figure 11, a.]

Four intrusive burials of later Indians were encountered near the surface. The deepest of these was 22 inches. The positions of two of these are shown in number 14 of the cross-section.

The construction of the mound was peculiar. The strata of the different sections varied considerably, and only three of the layers extended throughout the mound, namely: the concrete layer near

its base; the brown layer just above; and the second stratum from the top, consisting of clay mixed with sand and ashes.

Only four post-holes were noticed. These were beneath the concrete layer, and were in the northwestern section. Certain portions of the mound consisted of refuse material, and through-

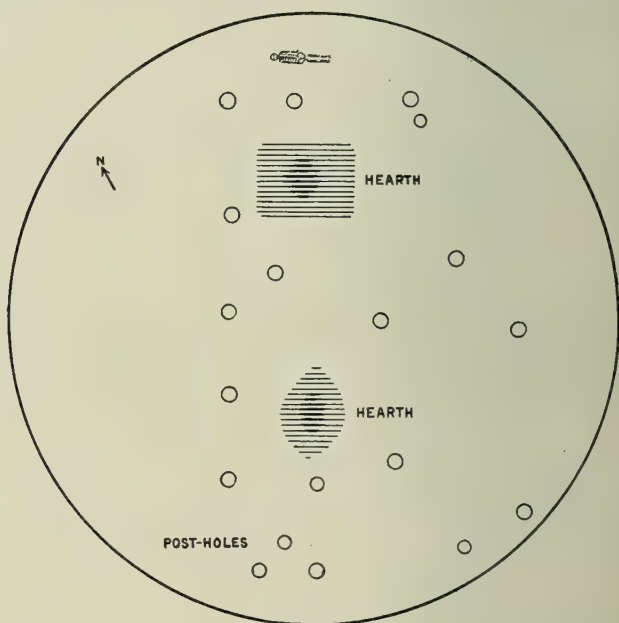


FIGURE 14
Plan of Mound 2.

out the earthwork were many animal bones, potsherds, broken bone awls, flint chips, bits of mica, and pieces of burnt clay.

Three feet from the outer side of the low outlining wall of stone, and to the northwest of the mound, was a small altar of burnt clay, 8 inches high, 3 feet long, and 2 feet wide (11).

Mound 2. This stood in the larger of the two earth circles within the great enclosure. The mound was 30 feet in diameter, and 2 feet high. Excavations revealed two hearths of burnt clay. Their positions and relative size are shown in the ground plan, figure 14. Nineteen post-holes were located and accurately plotted by triangulation, a method unfortunately not followed in the previous

work. (This was one of the last mounds of the group to be explored.) Only one burial was found, the bones being badly broken and decayed.

The earth circle was approximately 300 feet in diameter, with opening to the southeast. It was accompanied by a trench upon its inner side, which had been partially obliterated by cultivation. A section of the embankment was made at its highest point. Its base was composed of three or four layers of flat river stones

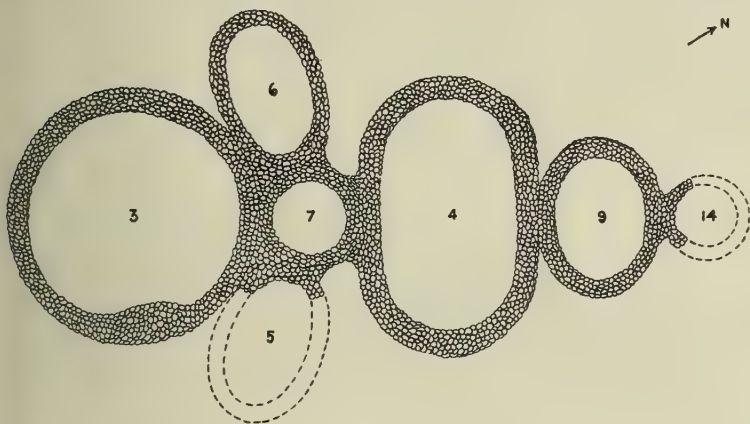


FIGURE 15

Plan of the seven connected altar mounds within the Great Enclosure, showing wall outlining base of each.

placed one above the other; these were covered with a low embankment of gravel.

Mound 3. This is the largest of the seven connected mounds in the southeastern portion of the great enclosure. Each mound of this sub-group was outlined by a low wall of stones, as indicated in figure 15, which was made from a sketch by Dr. Metz. In some instances, the outer edge of a layer of stones, wholly or partially covering a mound, joined this wall, as will be seen by referring to the various cross-sections.

Mound 3 measured about 100 feet in diameter at its base, and 14 feet at its greatest height. Its altitude had not been materially reduced by cultivation. This is conclusively shown by the layer of stones which covered it at a nearly uniform depth of 20 to 24 inches beneath its surface, as indicated in the cross-section,

figure 16. Over the central part of the mound, a second layer of stones occupied the position shown in the cross-section.

The greater portion of the material composing the mound consisted of clay, or clay mixed with gravel, stratified as illustrated. Upon removing most of this, a layer of yellow sandy loam (7), 3 to 6 inches thick, with a sprinkling of gray sand, was encountered resting on a thin stratum of yellow clay. This covered the lower part of the mound, about 2 feet above its base. Underneath this layer of yellow clay was a stratum of clay mixed with charcoal, about 2 feet in thickness, which reached to a layer of concrete (8) covering the floor of the structure.

The ground plan is shown in figure 17. A wall of varying width, about 2 feet in height (excepting upon the eastern side), built of

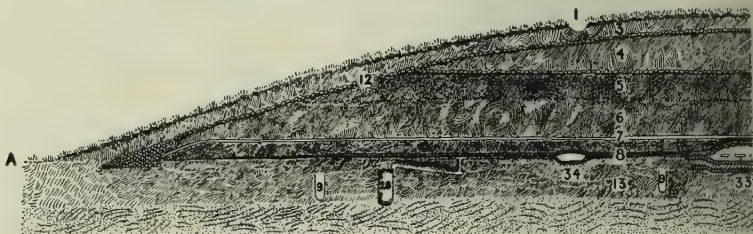


FIGURE 16. Cross-section of Mound 3: 1, Intrusive burial; 2, Intrusive pit of charcoal and ashes; 5, Clay; 6, Clay and gravel, mixed; 7, Yellow clay with tunnel and outer pit; 12, Layer of limestones; 28, Pit with tunnel and flues;

flat river stones, formed the outline of the base. The outer edge of the layer of stones, above referred to as covering the mound, joined this wall, as indicated in the cross-section. Bordering the inner edge of the wall and forming a part of the base of the mound, was a circle several feet in width, composed of loose gravel. The area within this circle consisted of a layer of ashes or clay showing the action of fire in places.

The Enclosing Wall. The low wall, from the inner edge of which extended the layer of stones covering the mound about 20 inches below its surface, was built of ordinary flat stones probably brought from the shores of the Little Miami River. Its base was somewhat below the level of the surrounding field.

As shown in the ground plan, the southeastern portion was carried inward until it reached a width of 15 feet. The following description is from Dr. Metz's notes:

The wall, that had on the south side of the mound a uniform height of 2 feet and a width at its base of 4 feet, acquired a width of 15 feet and a height of $3\frac{1}{2}$ feet on its eastern side. The stones of which the wall was composed were much larger than those used on the west and southwest sides of the mound.

Thirteen feet inward from the edge or beginning of the wall, it suddenly arched over, until it reached a height of $3\frac{1}{2}$ feet. This elevation extended 20 feet along the wall, and was 2 feet in width. When the stones were removed from its front side, an oblong oval-shaped recess was discovered [figure 16, 10] filled with irregular layers of ashes, sand, and clay burned red, the lower stratum being of black ashes and charcoal, 2 to 4 inches in thickness and 18 inches in width. In this stratum many fragments of burnt bone were found, and resting on the ashes was a large marine shell with its open side up, and near it lay several fragments of copper ear-ornaments, numerous shell beads, and a carved piece of deer horn representing a species of fish.

The cavity in which these were found was 30 inches high, 2 feet wide, and



containing two skeletons and sixteen skulls; 3, Top soil; 4, Clay with specks thin covering of sand; 8, Concrete; 9, Post-holes; 10, Place of cremation; 11, Pit 33, Central altar; 34, Small altar.

10 feet long. The layer of black ashes extended eastward 10 feet beyond the arched cavity, into and between the layers of stone forming the wall.

The floor of the recess was composed of three layers of large flat river stones, the top layer showing marked evidence of having been exposed to the action of fire. The lowest of the three layers of stone which formed the covering of the recess was much burned, and the middle layer also showed evidence of direct contact with the fire. No flue or chimney was found leading from this recess.

Below the stone floor of the recess was a bed of clay, 2 feet wide, and 15 feet in length. The wall extended but a short distance beyond the recess into the mound.

The objects taken from the ashes and burnt earth which filled the recess consisted of about two quarts of burnt human bones (plate 7, d), probably the cremated remains of a single individual; a large vessel made of the shell of *Fulgur perversa*; an antler effigy of a fish having the tail of a rattlesnake, and an opening beneath,

into which probably fitted the end of a small staff; a pair of copper ear-ornaments of joined discs, one of which was broken; about two hundred shells of *Marginella*, perforated for stringing; twenty-seven large shell beads of uniform size; and a few small shell and

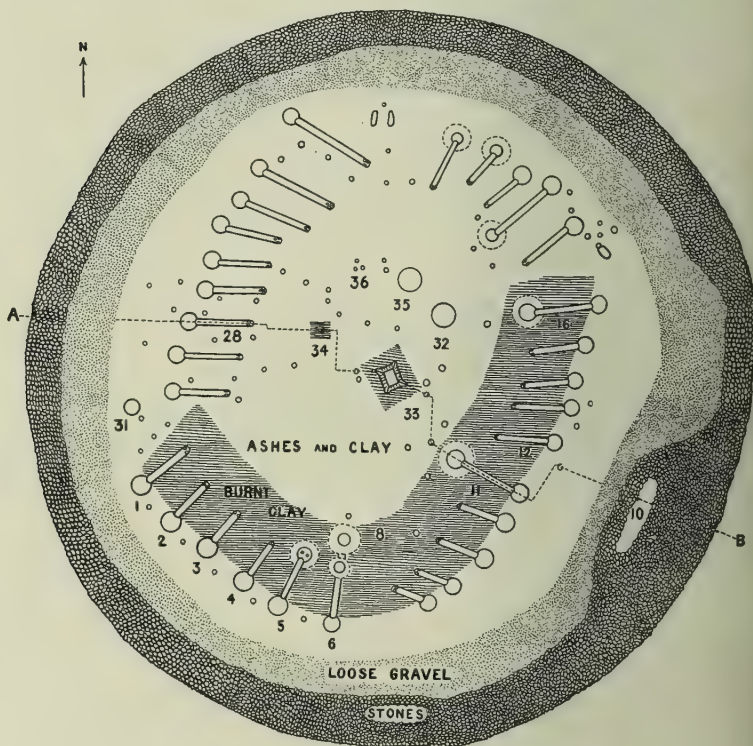


FIGURE 17

Plan of Mound 3: 1-6, 11, 12, 16, 28, Pits with tunnels; 8, Hearth of burnt clay; 10, Place of cremation; 31, Small pit with flue; 32, 35, Cache-pits; 33, Central Altar; 34, Small altar; 36, Post-holes.

pearl beads. These are shown in d, plate 6. None of these shows contact with fire.

It seems certain that this inner extension of the wall was built as a funeral pyre. First a platform of clay was made, about a foot high, upon which were laid three layers of flat stones. Upon these, the wood and other combustible material were placed, and

the body burned. It seems that before the fire had wholly died down, the remains were covered with clay and sand, over which three layers of limestones were placed.

One cannot be sure that this was not a place of general cremation, and that the ashes found were those of the last individual burned. It is very probable, however, that only one body was cremated here, evidently the remains of a person of distinction.

Pits and Tunnels. Upon removing the layer of concrete which covered a large part of the floor or base of the mound just above the level shown in the ground plan, six pits (numbers 1 to 6, figure 17) were discovered in a line running northwest from the southern portion of the mound; and beyond them a hearth or layer of burnt clay (8), 2 to 4 inches thick, was encountered. Portions of this layer showed excessive burning. Beneath it was a bed of black ashes. Dr Metz writes:

Just beneath the layer of concrete or burned gravel, a heavy stratum of burnt earth was observed. This was carefully uncovered and proved to be a hearth of semicircular form, conforming lengthwise to the curve of the mound . . . [number 8, figure 17]. The surface was burned to a hard red brick, 3 to 4 inches in depth, beneath which was a layer of black ashes, 3 inches in depth. Near the center of the [western section of the] hearth were two irregular spaces where the burning was evidently very intense and continued, the surface being a bluish gray, very hard and flinty. Immediately around this space the clay was of a very deep red color. Six concave depressions were observed extending partly across the hearth, 8 feet in length, 16 inches wide, and 2 to 3 inches in depth. [Tunnels were afterward found beneath these depressions, which were apparently the result of the settling of the earth above them.]

Rising above the hearth to the north of pits 5 and 6 were three cone-like elevations. These were 9 inches in height, about 30 inches in diameter, and showed but very slight burning. At the apex of one, two round openings, 2 inches in diameter, were observed. On looking into these openings, a pit partially filled with earth was discovered.

An examination of the hearth was made by cutting a trench directly across at the west end [near pit 1], including one of the depressions on the surface. The space between the encircling stone wall and the edge of the hearth was filled with black ashes and loose soil, to a depth of 2 feet. Four inches to the southwest of the depression on the hearth was the inner edge of pit 1, 30 inches in depth and 18 inches in diameter, containing ashes and coarse charcoal, its bottom showing marked evidence of the action of fire, being burned hard and red.

On cutting down the edge of the hearth by the side of pit 1, a singularly-shaped arched opening of a tunnel was revealed beneath the depression in the hearth. This tunnel was 12 inches wide, 11 inches high, and 8 feet, 7 inches in

length. [See longitudinal-section, figure 18, b.] Its floor was covered with pure white ashes, 2 to 3 inches in depth, containing small fragments of bone. On removing the ashes, the floor was found to be of yellow clay, showing no evidence of the action of fire. The bottom or floor of the tunnel was a concave depression, occupying almost the entire width of the tunnel at its mouth, and

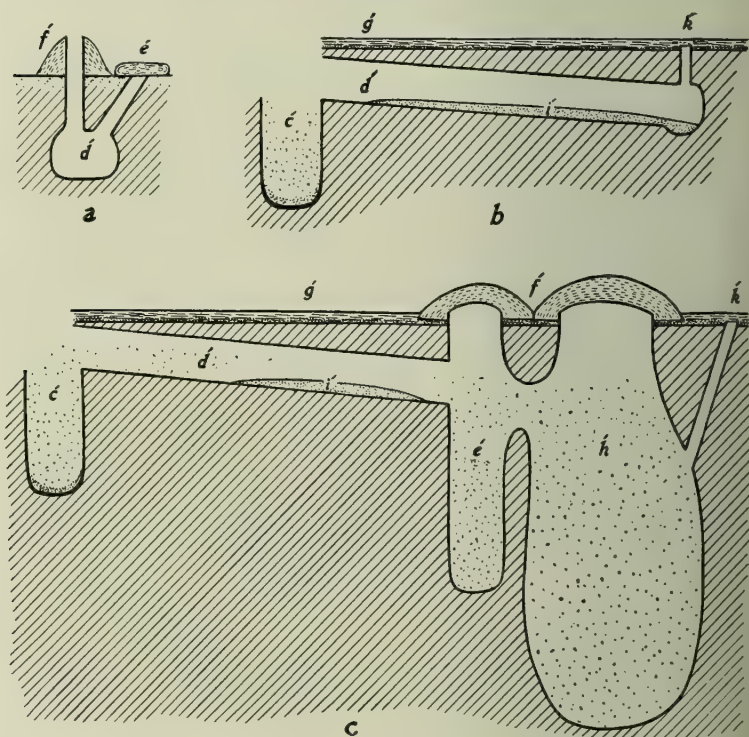
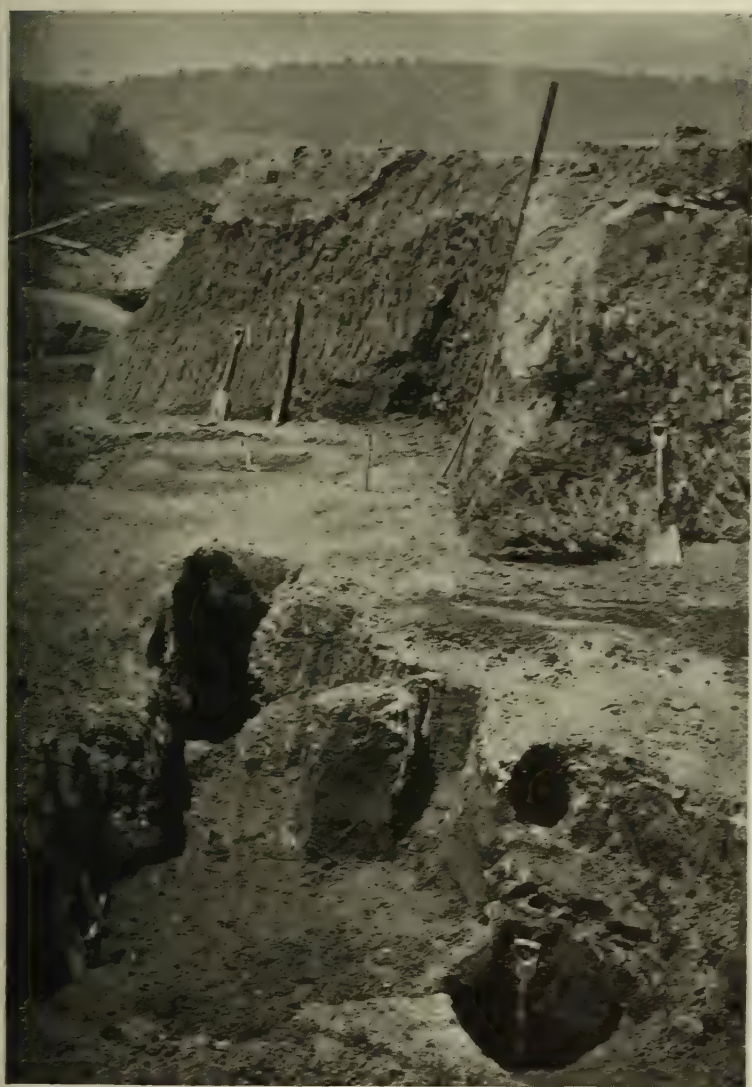


FIGURE 18

Mound 3. Cross-sections of pits and tunnels: a, Small pit (31) and flues; e, Stone covering flue; f', Clay cone; b, Pit and Tunnel 28; c, Pit 6, and connecting tunnel; g', Layer of burnt clay covering thin stratum of black ashes; f', Clay cones covering top of pits; i', Layer of ashes mixed with carbonate and phosphate of lime.

gradually narrowing until it terminated in a circular concave basin 2 or 3 inches deep at the rear end. From this depression or basin, two chimneys passed upward, terminating just under the burnt surface of the hearth. These chimneys were 25 inches in length, with a diameter of 2 inches. On their inner surface we noticed ashes, and the indication that heat and smoke probably at one time passed through them.

The tunnel contained only the ashes that covered the floor, and it sloped



Mound 3 partially explored, showing Central Altar (in middle distance marked by hatchets); the pit in front of Tunnel 12 (with handle of shovel), and cross-section of the tunnel; also outer pit of Tunnel 11 (with shovel and pick), and opening into its inner pit.

downward in the direction of the center of the mound, being 8 inches lower at its inner end.

In making a longitudinal-section of the hearth from northwest to southeast, 5 additional tunnels were found. Numbers 2 and 3 presented exactly the same condition as number 1, and had similar contents. Tunnels 4, 5, and 6 were

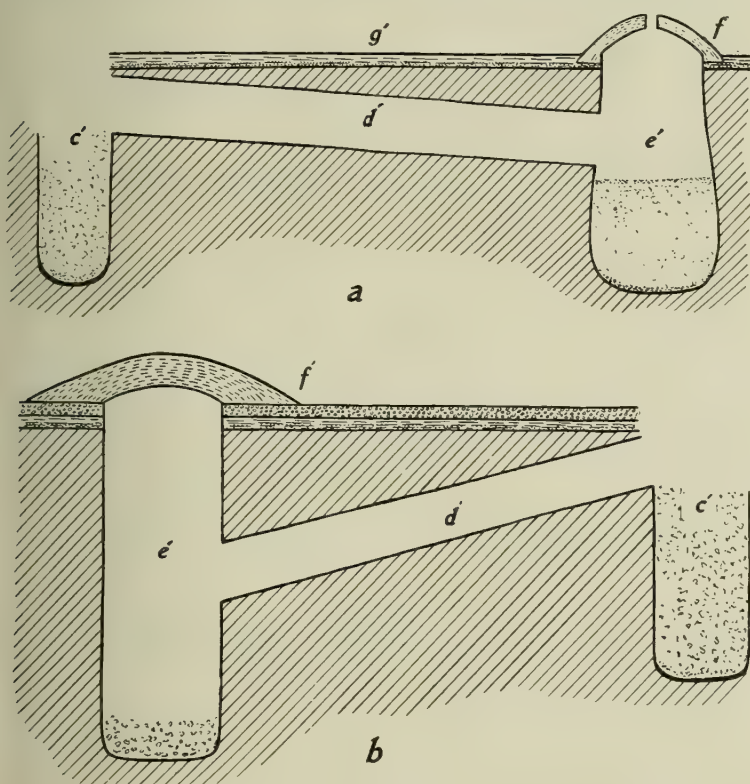


FIGURE 19

Mound 3. Cross-sections of pits and tunnels: a, Pit 5; b, Pit 16; c', Outer pit; d', Tunnel; e', Inner pit; f', Clay cap; g', Burnt clay, covering thin stratum of black ashes.

filled with loose black earth. Number 4 sloped deeper than the others, the flues or chimneys being 8 inches apart, 3 inches in diameter, and 27 inches in length. A small quantity of ashes was found on the floors of these tunnels. Tunnels 5 and 6 each terminated at its northern end, in a pit resembling somewhat the ash-pits of Ferris Woods. They were, however, each covered with a hood of clay showing evidences of having come in contact with fire at their tops.

In front of each of tunnels 2-6, at the southern end, a pit was discovered similar to the one found in front of tunnel 1. The tops of these pits were level with the bottom of the opening of the tunnels.

Tunnel 5 terminated at its northern end in a pit $4\frac{1}{2}$ feet deep, which was filled to a depth of 21 inches with ashes, gravel, several hard lumps of earth and ashes, and a few flakes of mica, the remaining portion being empty [figure 19, a].

Tunnel 6 terminated at its northern end in a double pit [figure 18, c], the first being 6 feet in depth and 14 inches in diameter. This contained ashes, sand, black friable soil, and a fragment of pottery. This pit was connected on its northern side with one deeper and larger, its dimensions being as follows: depth, 9 feet; greatest width, 4 feet. A flue, 2 inches in diameter, and 37 inches in length, extended from its northern side, at a point 3 feet from its top, obliquely to the hearth above. The pit was nearly filled with ashes, sand, charcoal, and several pieces of hard burnt clay.

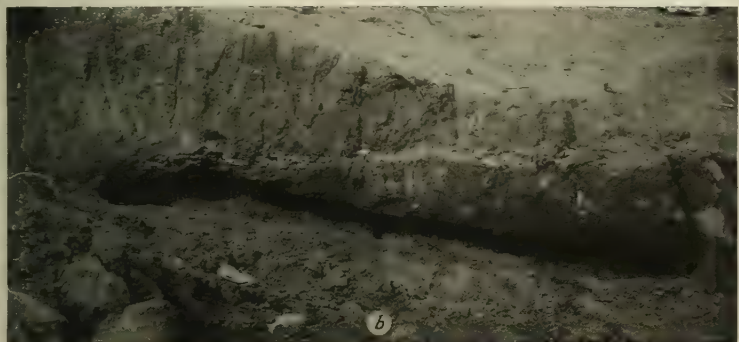
Ten feet northwest from the west end of the hearth, a cone-like elevation was found [number 31, figure 17, and a, figure 18], in the apex of which was a circular opening 4 inches across. This cone was 10 inches in height with a diameter of 13 inches at its base. The opening or flue extended downward 26 inches into a small pit, 11 inches in depth, and 15 inches in diameter. About a foot from the base of the cone, and on the same level, a flat stone was found covering a second flue, 4 inches in diameter, which extended obliquely downward, connecting with the small pit. This flue contained sand, ashes, and black earth.

In the space between the hearth and enclosing wall, and below the black soil and ashes, numerous little pits were found, 5 to 7 feet apart, following the course of the mound. A similar pit was discovered at the outer edge of the hearth between the larger pits in front of the tunnels. These small pits were 2 to 3 feet in depth, and 12 to 16 inches across, and contained fine sand and loose friable black earth. . . . Many small pits look as though great timbers had once been set in them, and that the fine friable brown and black earth was decayed wood.

These smaller pits were probably post-holes, and as the work continued they were found to be distributed over a considerable portion of the area covered by the mound.

Continuing excavations north and east, the area of burnt clay (number 8, figure 17), called by Dr. Metz 'the hearth,' was found to continue in a northeasterly direction, and a number of tunnels and large pits of the same nature as the ones already described were discovered beneath it. Similar pits and tunnels occurred also in the northern and northwestern portion of the base of the mound, their distribution being indicated in the ground plan.

The majority of the tunnels and connected pits were of the type illustrated in figure 18, b, and although there was some variance



a, Altar 5, Trench a, embankment of the Great Enclosure; b, Mound 3, longitudinal-section of Tunnel 28, and one of its flues; c, Mound 3, section of Tunnel 16, its outer pit (with handle of shovel), and opening into large inner pit.

in the length of tunnels, they nearly all terminated in two or three flues extending upward at the end opposite to that at which the pit was situated. The diameters of the flues ranged from 2 to 4 inches. Only one of these flues is shown in the longitudinal-section, b.

While many of the upright flues were round in cross-section, some were nearly triangular, one of the sides being curved. It is very apparent that, in their construction, the clay or earth was pressed around a stick, planted in the proper position, which was afterward withdrawn. Those approaching the triangular form were the result of using for this purpose a section of a small log which had been split into four or more pieces.

According to Dr. Metz:

The clay composing the inner surface of the sides and roof of the tunnels is very dry and friable, and does not show any signs whatever of having come directly in contact with fire. It seems as if the heat had been conducted through the tunnel to the flues at the back of each of them. In the flues no traces of fire can be found, except a very little white ashes adhering on the sides. In the pits directly in front of the tunnels, coarse charcoal and ashes are found in abundance, the bottom of the pits being burned red and hard, also the sides part way up. Was the heat from these pits conducted through the tunnels, and in what manner?

Longitudinal-sections of tunnels 11 and 28 are shown in relation to the upper portion of the mound in figure 16. Plate 8 shows the pit (with handle of shovel) in front of tunnel 12, with cross-section of the tunnel beyond it; also the outer pit of tunnel 11 (near pickax and shovel), with an opening into the large pit at its opposite end. Beyond this, in the middle distance, is the central altar marked by the hatchet.

A longitudinal-section of pits and tunnel 16 is given in figure 19, b, from Professor Putnam's drawing made June 2, 1884; and a photograph is reproduced on plate 9, c, showing a longitudinal-section of a part of the tunnel, the relative position of the smaller outer pit, and the opening made by the explorers into the larger pit, which contained a small quantity of charcoal only. Plate 9, b, gives an excellent longitudinal-section of tunnel 28 and one of the flues, looking north.

Pit 32, to the northeast of the central altar, was not connected with a tunnel. Dr. Metz writes:

On Friday, the 13th instant, we discovered another covered pit, 9 feet 8 inches northeast from the altar stake. This pit was 3 feet in diameter, 7 feet deep below the concrete, and 14 inches above the gravel to the top of the clay hood. This pit seemingly was lined with a row of thirty stakes, placed about 4 inches apart. They were 7 feet long, and apparently had been pressed into the clay of the sides while it was quite soft. The impressions left in the clay lining are 2 to 3 inches wide and about the same depth, and were filled with brown masses resembling decayed wood. This brown substance on being disturbed revealed fragments of wood. In the bottom of the pit a considerable amount of this substance, also ashes and charcoal, were found.

Ten inches from the northeast side of the pit was a flue, 3 feet long, and 2 inches in diameter. No connection between the two could be observed. In making an excavation to ascertain the depth and direction of this, a good section was obtained showing the manner in which the pit was probably constructed. It seems that an excavation had been made in the earth, which was lined with clay to a thickness of 4 to 6 inches, and while yet soft, stakes were pressed into it so as to retain the clay in place. In the bottom of the pit a grinding stone or mortar, about 18 inches long, was found, covered with sand and gravel.

It seems that this pit, and also number 35, must have been used for the storage of property. They had no connection with tunnels, and no indication of contact with fire. The upright hole, 3 feet in length and 2 inches in diameter, found 10 inches from number 32, apparently had no connection with the pit. This pit was covered with a clay cone, 14 inches in height at its center.

In a brief notice of the exploration of this mound by Professor Putnam,¹ he says that at the further (inner) ends of some of the tunnels the walls were covered with a thin glossy incrustation, evidently formed by the condensation of vapors. He also records in his notes that in some instances there was a hard lime-like lining on the bottom and sides of the tunnel. About a half bushel of "ashes" from the different tunnels was sent to the Museum. In the ashes are many irregular white porous masses of various sizes, up to two inches or more in length, which are fragments of the deposit from the floor or sides. Some of these have somewhat the appearance of bone nearly consumed by fire, and were thought by Dr. Metz to be such. A chemical analysis made under the direction of Professor Baxter shows them to be composed principally of carbonate and phosphate of lime.

Of the twenty-three tunnels of the type shown in figure 18, b, there are careful detail drawings of only a few, but there seems to

¹ Reports of the Peabody Museum, Harvard University, Vol. III, p. 340.

have been little variation in form or dimensions among them. Numbers 2 and 3 presented "exactly the same conditions" as number 1. In number 4, the tunnel had a greater slope, and the flues were three inches in diameter instead of two. Possibly the larger size of the flues in this example was made necessary by the greater slope of the tunnel.

By referring to the ground plan it will be seen that the burnt clay hearth in the southern half of the area covered sixteen of the thirty tunnels. So far as recorded, the upper opening of the flues terminated at the top of a layer of black ashes just below the bottom of this layer of burnt clay. This seems to indicate that the clay layer was deposited and burned, after the use of the tunnels had been discontinued.

The flue leading from the large pit of number 6 (figure 18, c, k') also terminated beneath the burnt clay layer, and the cone-shaped clay caps of numbers 5 and 6 rested upon the ashes beneath the hearth, which also seems to indicate that the latter was of subsequent construction, and may have had no direct connection with the function of the tunnels below. At any rate, it seems improbable, with the outlet of the flues of the tunnels closed with a compact and continuous layer of hard burnt clay, that they would be in working condition.

The earth below the base of the mound is composed of a layer of dark clay of considerable thickness, resting upon a gravel bed. In this clay the tunnels and connecting pits were constructed, some of the larger pits extending through the clay layer into the gravel.

At the time of the use of these pits a building of some kind undoubtedly occupied the site, as is indicated by the many post-holes found throughout the area. Unfortunately the method of locating these holes was not very accurate, and it is possible that some of the less conspicuous ones were not noticed.

A casual glance at the ground plan, figure 17, gives the impression that the tunnels are earth moulds left by fallen and decayed timbers which originally formed the main rafters of a building, and that the pits at the outer end of each originally held a substantial supporting post. A careful examination of the numerous notes, sketches, plans, and photographs, made during the exploration, however, does not substantiate this impression. The curious upright flues at the inner end of each of the tunnels not connected

with an inner pit, the careful junction with the inner pit of each tunnel so connected, and the uniform position of the outer openings of the tunnels above the outer pits, seem to indicate beyond doubt that they were planned and built in the position they now occupy. If the large inner pits of numbers 5, 6, 11, and 16 were for cache purposes, of what use were the tunnels and flues connected with them?

Pits with somewhat similar arrangement of flues as shown in figure 18, c, k', but without tunnels, were found by Mr. Guernsey in a Basket-maker cave during the exploration in Arizona by the Museum, and are figured in the report.¹ These are thought to be for storage, as no signs of fire having been in them were noticed. Dr. Hough figures a large pit, 6 feet deep, also supplied with a flue.² This was built by the Hopi Indians for roasting corn.

In a letter to the writer, Dr. Hough gives the following explanation of the use of this flue:

The flue running diagonally from the corn pit among the Hopi Indians is for the purpose of allowing a draft when the pit is first heated. A hole is dug in rather good solid ground, the flue is driven into it, and the pit is filled with firewood, ignited, and kept burning for a considerable while until it is believed to be hot enough. There is very little charcoal in the wood used so that at the bottom of the pit when the fire is out, there is merely a mass of ashes. Cornstalks and shucks are thrown in on this and then a layer of ears of corn, filling the pit, which is closed over with cornstalks and earth, and in many cases a fire is made on top of this. The flue is closed at the same time. The corn remains in this pit generally overnight, when the contents are taken out with great rejoicing. When the pits are opened a tremendous amount of steam rises in the air to the height of about 100 feet.

While it is possible that pits of the type of 5 and 6 may have been used for a purpose similar to the above, it seems doubtful if the tunnels terminating in small upright flues, and not connected with large pits, were used in food preparation.

Further exploration of similar remains will be necessary before definite conclusions can be drawn.

The Altars. The central altar, from which the remarkable collection of artifacts was taken, was situated in the middle of this

¹ Guernsey and Kidder, *Basket-maker Caves in Northeastern Arizona*, Papers of Peabody Museum of Am. Arch. and Eth., Vol. VIII, No. 2, p. 19, plates 9, d, 14, a.

² Walter Hough, *Hopi Indian Collection in U. S. Nat. Mus.*, Proceedings of U. S. Nat. Museum, Vol. 54, fig. 3.



From the Central Altar of Mound 3: Objects wrought from native copper. (1/3.)

area; see number 33, figures 16 and 17; in plate 8, the hatchet in the middle distance lies in the basin of the altar. The basin was nearly rectangular in form, with the corners rounded and projecting somewhat beyond the line of the sides, and measured a little over 5 feet diagonally from corner to corner. It was made by digging a cavity of the proper dimensions in the floor, and lining it with clay. From about the level of the floor, its sides sloped inward 10 inches to its bottom, which was about 7 inches below the level of the field. Its sides and upper edge were burned a brick red to a depth of $1\frac{1}{2}$ inches, and its bottom to a depth of 4 inches. About 10 inches below the floor of the altar was another layer of burnt clay, probably the remains of an earlier altar. The space around the altar also showed the action of fire. A few feet to the northwest, a second and much smaller altar was found (34 of plan and section), its basin being filled with ashes in which were charcoal, fragments of burnt bone, and a few potsherds.

North of the central altar was a refuse pile of ashes mixed with broken animal bones, potsherds, and other waste material. Just above the stones which covered the altar was a layer of concrete, 2 to 4 inches thick, extending over the altar, and covering the greater portion of the floor of the mound. It seems that this concrete layer was spread over the covered contents of the altar and the floor of the original structure, when the use of the structure was discontinued. This layer evidently formed the first stage of the mound proper, as nothing of special interest was found above it excepting the intrusive burials, to be described later.

Dr. Metz gives an account of the discovery of the central altar in the following words:

Nothing of importance occurred until the layer of hard gravel or concrete near the bottom of the mound was reached and gone through, when a layer of loose stone was encountered, beneath which was a stratum of fine clean sand. Projecting from under the sand was the margin of a large sheet of mica. Upon removing a little of the sand, a perforated sheet of copper was seen resting upon the mica. . . . The next morning, Mr. Low and I commenced the investigation of the find, which proved to be an altar containing beads in great quantity, copper ornaments, mica ornaments, etc. Placed over the whole were three large sheets of mica.

The altar was quadrangular in form, the corners conforming to the cardinal points of the compass. Many of the pearl and bone beads and other objects were more or less calcined and mixed with ashes. The larger ornaments were arranged in three distinct heaps, each heap being covered by a large sheet of

mica, while the smaller beads were arranged around and between the heaps, the whole being covered with a layer of clear, clean sand, 4 inches thick, and having upon its upper surface a peculiar pinkish red stain evidently derived from the layer of flat river stones which covered it, and which also showed the stain.

Mr. E. F. Low, who was with Dr. Metz at the time the objects were removed from the altar, in a letter to Professor Putnam, gives a few additional details:

Having removed the earth we discovered a large sheet of mica, and great pains were taken to get it out whole. While excavating above it, the copper object [plate 10, e] was taken out, and the sand was filled with glittering pearl beads which rolled out in great quantities. It was a sight to see Dr. Metz scooping them up in great double handfuls, filling box after box. . . . I noticed that in the center where the coals and ashes were thickest and blackest that many of the teeth and shell beads were calcined, as though they had been deposited before the fire was wholly extinguished, and while the embers were still hot.

Contents of the Central Altar. The following objects were taken from this altar: 35 small nuggets of native copper, some of them hammered; 28 symbols or ornaments wrought from copper; 50 copper spool-shaped ear-ornaments, some covered with thin sheets of meteoric iron or silver; 3 copper bracelets, one of which is covered with thin silver; a copper adze blade; 700 copper beads of various forms; several copper or meteoric iron-covered clay buttons, pierced near the bottom for attachment; copper-covered beads of wood; several small nuggets of meteoric iron, and numerous beads and other ornaments wrought from this metal; small sheets of gold, each hammered from a small nugget; 3 large crystals of mica cut to irregular ovals; about 50 ornaments or ceremonial objects cut from thin mica, some of which are painted; the remains of several large vessels made from busyon shells; about 600 phalanges of small animals; artificial canine teeth of the bear made from shell; 4500 shell beads of various forms, some of them large; 500 marginella shells perforated for suspension; 17,000 embroidery shells (*Leptoxis*) with one side ground away for the passage of cord for fastening them to the fabric or dressed skin; 36,000 pearl beads of all sizes, from less than $\frac{1}{8}$ of an inch to $1\frac{1}{2}$ inches in diameter; 12,000 pearls, unperforated; 36 or more canine teeth of the bear, perforated for attachment; 12 alligator



From the Central Altar of Mound 3: Objects wrought from native copper. (1/3.)



From the Central Altar of Mound 3: a, Pendants of native copper; b, Native copperbeads; c, Ear pendants of native copper, a few being overlaid with native silver; d, Shell beads; e, Canine teeth of small mammals, perforated; f, Canine teeth of the bear, perforated. (1/4.)

teeth; 2000 canine teeth of small mammals, perforated for suspension; 600 unworked phalanges of small mammals; 34 cones or tinklers made from the tips of deer antler; 27 chipped blades, 11 of which are of obsidian; 11 ceremonial spear points or blades made of micaceous schist; 3 terra-cotta ear-ornaments; 2 elaborately incised discs of bone; and a tortoise shell spatula-like object. Most of the above were in a fair state of preservation, although many were discolored by smoke, or partially destroyed by fire. In addition to these there were thousands of fragments of various objects which had been destroyed by fire. The numbers given for pearl beads, embroidery shells, and similar objects, are estimates only, made, for example, by counting the number of specimens in a fraction of a pint, and measuring the total amount of each group. The different groups of the above objects will be described in detail.

Copper Objects. The specimen illustrated in plate 10, e, which is probably a conventionalized eye, was apparently the last to be deposited on the altar, as it was found just above the three large crystals of mica placed over the contents of the altar. Like the other specimens upon plates 10 and 11, it is made from a thin sheet, which was prepared by hammering, annealing, and grinding a piece of nearly pure native copper to the proper thickness. It was cut into the desired form, probably with sharp flints, the edges being finished afterward by grinding. The writer's experiments in copper working with primitive tools show that the more elaborate artifacts of copper were probably produced in this manner.¹ Several of the more advanced prehistoric tribes within the limits of the United States had become very skilful workers in this metal.

Most of the pieces illustrated are of nearly pure copper, but some of the larger and coarser objects from the Ohio mounds were probably made of copper containing a certain percentage of arsenic. This is not easily wrought, and has to be repeatedly annealed; but for certain tools, such as drills, adze and axe blades, it is probably superior, for after being hammered it is harder and retains its cutting edge longer than the purer metal. Some varieties, such as algodonite, are wrought with great difficulty. Numerous

¹ C. C. Willoughby, *Primitive Metal Working*, American Anthropologist, n. s., Vol. V, 1903, p. 55.

nuggets of this form of copper were obtained from the deposits in the Hopewell Group of mounds, and a few pieces apparently of this variety were taken from the altar of mound 4 of the group under consideration.

What seems to be a frontal ornament for a head-dress is shown on plate 10, g. Two of these, one of which was doubled together twice before being placed on the altar, were found. The small plate or gorget illustrated in plate 10, a, is a type not uncommon in the graves of the Great Earthwork Builders. They are usually considerably larger, however, than this example. A better specimen accompanied a skeleton at the base of Marriott mound 1, just west of the elevated circle. The objects shown in a, plate 11,

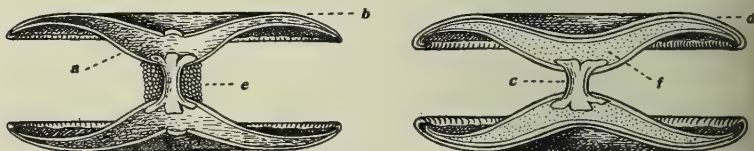


FIGURE 20

Cross-section through copper ear-ornaments. In the common type (at the left), two double discs are held together by a piece of thin copper rolled into a hollow rivet, and are held apart by winding the rivet with twine, e. In the other example, the rivet, c, is held securely by a clay filling, f. Both forms are sometimes covered with an additional exterior plate of fine copper, silver, or meteoric iron. (1/1.)

evidently represent the four horns of the serpent or serpent-monster, as will be apparent upon comparison with those figured in b, plate 19. They were probably attached to the object of which they formed a part by a projection at the base of each, only one of which now remains. Upon the breaking away of the projection in two of the specimens, the horns were evidently attached by means of the perforations.

The two perforated discs with scalloped outer edges (c) are probably eyes of the same serpent effigy, the body of which was doubtless destroyed by fire. Somewhat similar eyes with undulating rays instead of scallops appear upon an exquisitely carved stone head of a fawn (?) illustrated by Squier and Davis (figure 163).

The crescent-shaped object (b) is probably a gorget. A number of these have been taken from mounds and graves of this culture group. Seventeen copper pendants, thirteen of which are illustrated in this plate, were found together.

Three copper bracelets are shown in the upper part of plate 10. One of these (d) was twisted out of shape before being deposited. Each bracelet is hollow, with an opening on the inner side, a cross-section through its wall being C-shaped. The surface of b, has been injured by corrosion, and fragments of carbonized shell, bone, etc., adhere to it. The bracelet illustrated in c, is covered with very thin beaten silver.

The only copper implement from this deposit is the adze blade, f, plate 10. The better preserved of the copper spool-shaped ear-ornaments from this altar are illustrated on plate 12, c. A very small one, probably made for a child, is shown at the extreme right. Many fragments were also recovered. The general method of construction may be seen by referring to figure 20. This form of ornament was very popular among the Indians of this culture group. They were found in many of the graves and mounds, and more than five hundred were taken from one of the altars of the Hopewell Group of mounds in Ross County by Mr. Moorehead. In three or four of those shown in c, of the above plate, the outer discs are covered with thin sheets of silver. A few are covered with sheets of meteoric iron.

Dr. Hildreth found a similar silver-covered ear-ornament with a skeleton in one of the mounds at Marietta in 1819, and mistook it for a part of an European sword belt or buckler. He also found with it a corrugated ornament of silver, of the type shown in figure 21, which he thought to be part of a sword scabbard. These specimens are responsible for the alleged recent origin of some of the mounds of the Marietta Group, as asserted by several well-known archaeologists. The specimens found by Hildreth¹ are now in the Peabody Museum, and are unquestionably of pre-historic Indian origin.

The hollow cone-shaped objects shown in plate 12, a, made by rolling together thin sheets of copper, were probably pendants. Objects of similar shape and size produced by cutting away the interior of the tips of deer antler were also taken from the altar. Smaller pendants of tin of the same nature were used by historic tribes over a wide area, as ornaments for clothing, bags, etc. The

¹ Calib Atwater, *Description of the Antiquities Discovered in the State of Ohio*, Transactions and Collections of the American Antiquarian Society, Vol. I, p. 168. Professor Putnam was the first to call attention to the true nature of these objects; see note, Reports of Peabody Museum of Am. Arch. and Eth., Vol. III, p. 172.

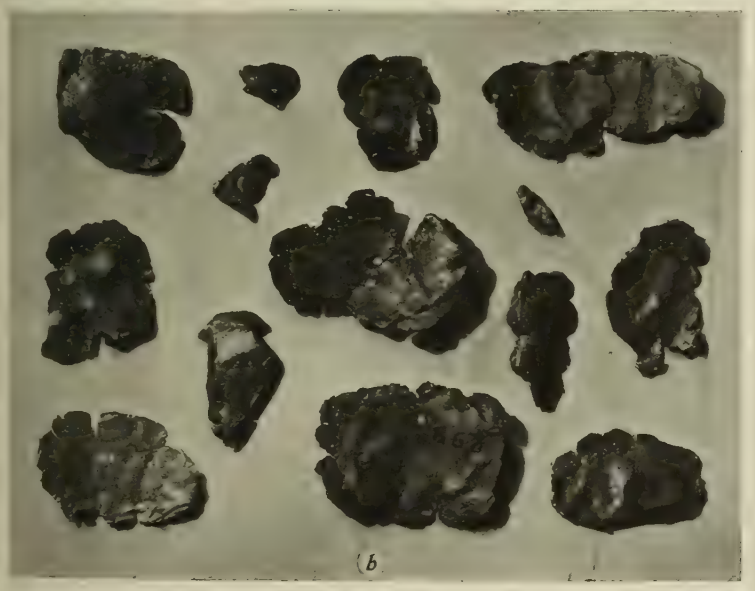
smaller end is attached to a thong, and a bunch of hair, often dyed a brilliant color, usually projects from the larger end.

The majority of the copper beads were of the type and size shown in b, of the above plate. About one hundred and fifty small tubular beads made by rolling up thin sheets, and a dozen large hollow beads of the form illustrated in plate 10, h, were also found. A few copper-covered wooden beads (i) were recovered, together with a number of hemispherical clay buttons, also covered with thin copper (figure 25, a-c). It is generally conceded that most of the copper used by the Great Earthwork Builders of southern Ohio came from the mines on the southern shore of Lake Superior. Several nuggets of copper, a few of them showing signs of having been hammered, were taken from this altar, but they were all small, the largest weighing only two ounces.

*Meteoric Iron Objects.*¹ Very few artifacts of this metal were recovered from the altar of mound 3. There were several small nuggets unworked or slightly hammered, and fragments of what may have been a head-plate of the type occasionally found in the Ohio mounds. These head-plates are usually 2 to 3 inches wide, and 10 to 12 inches long, curved and rounded to fit the crown. There also are pieces of hollow beads similar to those of copper already described, and several copper ear-ornaments of the usual form covered with thin sheets of meteoric iron.

The best preserved object of this metal is made of a thin sheet about $3\frac{1}{2}$ inches square, bent into the shape shown in figure 21. One side is corrugated, and the other flat. A number of similar specimens have been taken from the mounds of this culture group, made of silver, copper, and meteoric iron. The one of silver, found by Dr. Hildreth in a mound at Marietta and mistaken for a part of an European sword scabbard, is the most noted of these. There is a well-preserved example in the Museum from central Tennessee, from a mound belonging to this culture. It was accompanied by a copper adze blade, spool-shaped ear-ornaments, and mica plates. This Tennessee specimen had originally surrounded what appears to have been three tubes of cane or reed, fragments of which have been preserved by copper salts. It is

¹ For an analysis of the meteoric iron objects from the altars of this mound group see Leonard P. Kinnicutt, *Report on the Meteoric Iron from the Altar Mounds in the Little Miami Valley, Ohio*, Reports of the Peabody Museum of Am. Arch. and Eth., Vol. III, pp. 381-384.



From the Central Altar of Mound 3: a, Pearls, perforated for stringing; b, Native gold, hammered into sheets from small nuggets. (1/1.)

probable that each of the specimens above mentioned served to bind together three similar tubes. These tubes must have been usually about $\frac{1}{2}$ inch in diameter; but in one example in the Museum, a silver band from a mound at Grand Rapids, a northern outpost of this culture, the tubes were probably about the size of an ordinary lead pencil. Perhaps the tubes may have been whistles of different notes joined together into a single instrument.

Nearly all of the artifacts of meteoric iron from the mounds are badly oxidized, and more or less broken. This metal, when worked

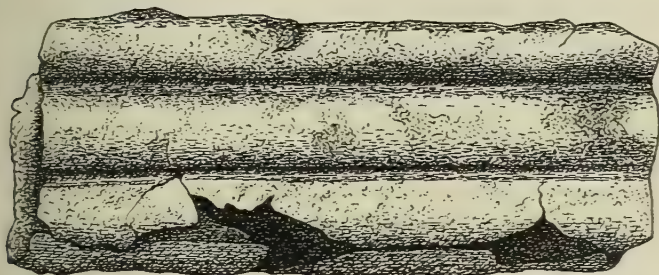


FIGURE 21

From the Central Altar of Mound 3: Meteoric iron band corrugated upon one side. (Nearly full size.)

into ornaments, does not have the lasting quality of copper or silver. Objects made of it, however, were originally very attractive, as the iron, which contains more or less nickel, resembles polished steel when finished. Further notes in connection with this metal will be found on page 65.

Silver Objects. No specimens made entirely of silver were recovered from this altar. A few ear-ornaments, a bracelet, and a cone-shaped tinkler, all of copper, were overlaid with thin silver sheets. Two of the former have been referred to (plate 12, c), and the bracelet is shown in plate 10, c. Among the debris of broken and burnt objects were many fragments of this thinly hammered overlay, evidently from various articles which had been destroyed.

No silver nuggets or partially worked pieces were found in any of the Turner Group mounds, but the Museum has two large nuggets of unworked silver, weighing together $12\frac{3}{4}$ pounds, from

one of the mounds at Grand Rapids. The source of most of the silver from the mounds of the Great Earthwork Builders is probably the copper region of Lake Superior.

Gold Objects. Fifteen sheets of gold, each hammered from a small nugget, were taken from this altar. Fourteen of these are illustrated on plate 13, b, and the remaining one is shown adhering to the copper pendant, d, plate 11. This adhesion is the result of corrosion. The gold did not form a part of the pendant. The piece shown in the center of the former illustration is concavo-convex, and is perforated. Its form would indicate that it possibly may have been fastened to one of the discs of an ear-ornament. The remaining pieces, although hammered to thin sheets, do not seem to have been cut or otherwise worked. They were probably prized for their rarity. In this connection it may be well to quote from a letter of Dr. Hildreth to the President of the American Antiquarian Society, dated November 3, 1819,¹ which evidently refers to one of the ear-ornaments so often found in or near the hands of skeletons. This report was traced to its source by Squier and Davis (page 279), and the ornament found to be copper.

I also have been told on good authority that an ornament composed of very pure gold something similar to those found here, was discovered a few years since in Ross County, near Chillicothe, lying in the palm of a skeleton's hand in a small mound. This curiosity I am told is in the [Peal] Museum at Philadelphia.

Atwater² also says, "gold ornaments are said to have been found in several tumuli, but I have never seen any."

Such objects must have been extremely rare, for the remarkable collection from the Hopewell Group of mounds contained no artifacts of this metal. If gold objects were in use, one would expect to find only small articles, such as clay buttons, wooden beads, or perhaps an occasional ear-ornament, covered with thin sheets hammered from small nuggets.

Pearls. On plate 14, d, and e, are shown twenty-three pounds of pearls taken from this altar. These two piles contain approximately thirty-six thousand. In addition to these were several thousand which had been destroyed by the altar fire, and most of those recovered were blackened or discolored by the heat and

¹ Atwater, *op. cit.*, p. 176.

² *Ibid.*, p. 223.



From the Central Altar of Mound 3: a, Massive shell beads; b, Marginella shells perforated for stringing; c, Leptoxis shells ground for embroidery; d, Pearls; e, Pearls perforated for stringing. (About 1/4.)

confined smoke. The pearls shown in the lower pile, e, are perforated, and were used as beads; those in the upper pile, d, are without perforations. A selection of some of the larger beads are illustrated in plate 13, a. It is probable that most, if not all, of the pearls from this altar were derived from various species of the *Unio* which were common in the fresh water streams of the South and West.

Pearls were found with several skeletons in the graves and mounds of this group, and a few were taken from two of the other altars. They were used for necklaces, bracelets, and probably for bead embroidery. They were employed as eyes for various effigies, and were inlaid in bear teeth toggles, stone tobacco pipes, and ornaments of shell. By far the greater number had a single perforation, and the surface was otherwise unworked. Frequently, however, and especially when used as an inlay or button, one side of a large pearl would be ground flat, or nearly so, and the perforations made by drilling two holes diagonally inward from the base until the holes met in the center, as shown in the third pearl from the left in the lower row, plate 13, a. In this way, the attaching cord would not be visible when the pearl was in place.

Two other large deposits of pearls were obtained from the Hopewell Group by Mr. Moorehead, in 1890. Approximately nineteen thousand were taken from altar 1 of the great mound, and about sixteen thousand from an extensive deposit of objects above two skeletons in the same tumulus.

Pearls were highly prized and eagerly sought by the more advanced tribes of the eastern and central portions of the United States. In a Fidalgo of Elvas narrative of De Soto's expedition, he tells us that upon the arrival of the Spaniards at Cutifachiqui, a town on the Savannah River, Georgia:

The Cacica, observing that the Christians valued pearls, told the Governor that, if he should order some sepulchres that were in the town to be searched, he would find many; and if he chose to send to those in the uninhabited towns, he might load all his horses with them. They examined those in the town and found three hundred and fifty pounds weight of pearls, and figures of babies and birds made of them.¹

¹ Narratives of the Career of Hernando de Soto, Edward Gaylord Bourne Edition, Vol. I, p. 66.

The "figures of babies and birds" were probably embroidered upon fabric or buckskin.

At Mauilla, a town in southern Alabama, the pearls which had been collected by De Soto from the Indians were destroyed when the village was burned. When the Governor learned that Maldonado was waiting for him at the post of Ochuse, he caused Ortiz to keep the news secret, because the pearls which he wished to send to Cuba, that their fame might raise the desire of coming to Florida, had been lost.¹

There are many references, by early writers, to the pearls found in possession of the Indians. Strachey writes of having seen

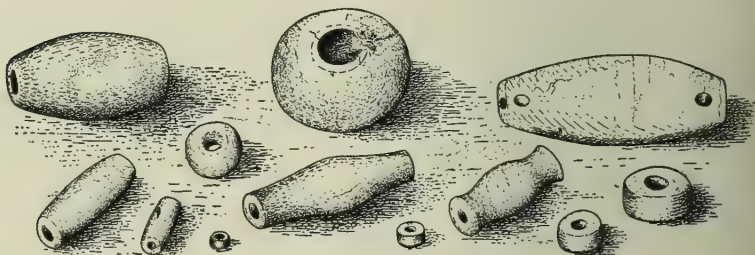


FIGURE 22

From the Central Altar of Mound 3: Shell beads of various forms. (Nearly full size.)

"manie chaynes and braceletts" of pearls worn by the Virginia Indians; and "wee found plentie of them in the sepulchres of their kings though discoloured by burning the oysters in the fier, and deformed by gross boring."² Numerous other references might be quoted, but the above are sufficient to show how highly the Indians valued these beautiful objects.

Shell Beads. Nearly five thousand shell beads were taken from the altar. They ranged from small discs, about $\frac{1}{8}$ of an inch in diameter, to those of globular or oval shape, approximately an inch in length, as illustrated in a, plate 14. On plate 12, d, are shown about two thousand of the ordinary form. Nearly an equal number, barrel-shaped, and somewhat larger, were also recovered. The various shapes and sizes of shell beads from this altar are shown in figure 22.

¹ Ibid., pp. 97-98.

² William Strachey, *A History of Travail into Virginia Britannia*, Hakluyt Society.

A group of marginella shells with the apex ground away for the passage of a cord is illustrated in plate 14, b.

Embroidery Shells. Approximately seventeen thousand fresh water shells (*Leptoxis carinata*), about a third of which are illustrated on plate 14, c, were recovered. Each of these is ground upon the side having the aperture, until the wall of the whorl above the aperture is perforated. This allows the thread used in attaching the shell to the fabric to pass through the perforation and out of the aperture; the ground side of the shell is in this way brought snugly against the fabric or buckskin to which it is fastened.

The best example of shell embroidery of this nature known to the writer is the so-called Powhatan mantle entered, about 1685, in the manuscript catalogue of the Ashmolean Museum, in the handwriting of Dr. Plot, and which is illustrated on plate xv of the Tenth Volume of the Bureau of American Ethnology. According to Dr. Taylor's description, thirty-three of the thirty-four figures still remaining on this garment are made with beads ground as above described, although of a different species of shell.

Canine Teeth. The canine teeth of various animals were highly prized as ornaments by many Indian tribes, and a large number were obtained from this altar. A group of the best preserved teeth of the bear is illustrated in plate 12, f. These are black with the confined smoke of the altar fire, and many others were destroyed by burning.

Most of these large teeth were perforated by drilling two holes upon one side, at an angle to each other, until they met near the center of the tooth. Through this angular perforation, the cord or thong which fastened the tooth to the garment doubtless passed. They were probably used as ornaments or toggles, and where found in graves were usually in one or more pairs, as will be seen by referring to plate 6. Sometimes they have an additional lateral perforation near the root end, and some are without the diagonal drilling. A few neatly cut bear teeth were also taken from the altar, two of which have holes for a pearl inset. Several artificial bear teeth made of shell, and one or two of bone, were also recovered.

A large number of the canine teeth of small mammals, perforated near the root end, for use as ornaments or for stringing as

necklaces, are shown in e, of the above plate. Among the various animals represented are the dog, fox, raccoon, bay lynx, badger, and opossum.

Mica Objects. In addition to the three large crystals of mica which capped this sacrificial deposit, there were many ornaments or ceremonial objects cut from thin sheets of this mineral. The more important of these are illustrated on plate 15. There were two grotesque human heads, one of which is shown in c. These are duplicates of each other, both in outline, and in the incised lines upon the surface which indicate the hair, the eyebrow, the lips, and the circle about the eye. At least a portion of the profile was painted, for traces of red paint still adhere to the neck. There are four or five small perforations along the upper lip, as though something had been sewed to the effigy at his point.

There are five representations of the upper portion of a bear, three of which are shown in the plate. These are excellent examples of the artistic skill of this people. The accuracy of the outline of the head and back is remarkable. In addition to the incised lines which mark the designs, portions of the surface of each of these effigies are painted with a dark red pigment. There were fifteen of the designs figured in b, which represent a conventionalized bird upon or against a long and narrow background. Some of these, while reproducing the same design, are not exact duplicates of each other. Portions of the wing and lower part of the bird are indicated by incised lines, and certain parts are painted red.

In addition to the above are several discs, some of which have a hole in the center. A few of these have concentric circles in incised lines, and traces of what appears to be white pigment. Many pieces of narrow serpentine figures were also recovered, and several hundred fragments of other designs, destroyed beyond the possibility of restoration.

Mica was highly valued by the Great Earthwork Builders. It was probably obtained by them from the Indians of Virginia and North Carolina, where it was quarried in prehistoric times.

Incised Drawings. Among the most remarkable specimens from the altars and graves of the Great Earthwork Builders are the incised designs upon bone, some of which have already been described (see plate 2).



From the Central Altar of Mound 3: Effigies, rings, and discs cut from mica, some of which are painted. (1/3.)

Figures 23 and 24 illustrate two of these from the altar under consideration. The discs are cut from the parietal bones of a human skull. Like all work of this class its technical quality is excellent. The lines are clear-cut and uniform, and the work is carried out with great precision.

These discs were broken into many pieces, and partially destroyed by burning, but practically the whole design of each can

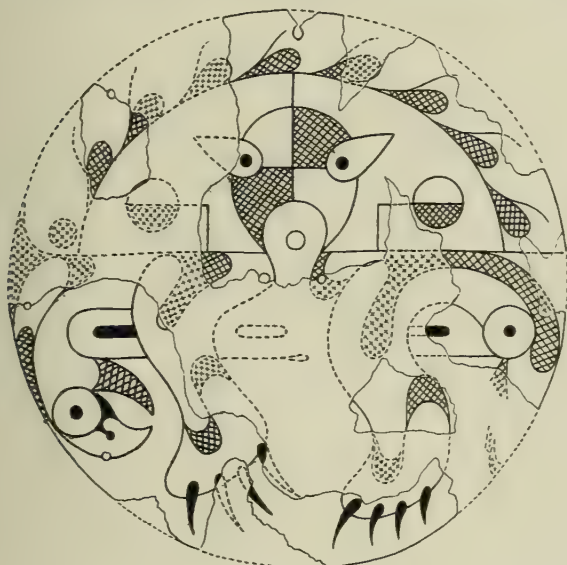


FIGURE 23

From the Central Altar of Mound 3: Disc cut from the parietal bone of a human skull, and ornamented with bird forms in incised lines. (2/3.)

be made out, for it is the same in both, although reversed. A composite bird is represented. The main or central portion is doubtless intended for an owl, as it has the usual ear tufts and large legs, each of the latter terminating in four claws, characteristic of this bird. Near the edge of each disc is the well-drawn head and shoulder of a crested bird whose wings, with conventionalized feathers, extend upward and across the upper half of the disc. Upon the opposite side of each is another bird's head, which seems to form a part of the leg or wing of the central figure. Two

large eye-like designs with angular arms are in the upper half of each disc.

A few fragments of other carvings of a similar nature were found among the ashes of the altar. There was also a spatula-like object of tortoise shell about 8 inches long, $1\frac{1}{8}$ inches wide near its broader end, and tapering to $\frac{5}{8}$ of an inch at the opposite extremity. The broader end is neatly rounded, and upon one side has been incised



FIGURE 24

From the Central Altar of Mound 3: Disc cut from the parietal bone of a human skull and ornamented with the same design as figure 23, but reversed. (2/3.)

a well-executed scroll. The greater portion of the unit of the design is repeated once. Unfortunately, the surface of the tortoise shell is so disintegrated that the lines of the design cannot be followed with accuracy, and a satisfactory drawing cannot be made.

Stone Implements. Comparatively few stone implements were taken from the altar. Six broken flint blades, 5 or 6 inches in length, of ordinary workmanship; about a dozen perfect knife blades of obsidian and flint, five of which are shown on plate 16,



From the Central Altar of Mound 3: a, Knife blades of flint and obsidian; b, Ceremonial blades (?) of micaceous schist. (2/5.)

a; and many fragments of similar blades, broken by the fire, were recovered.

Eleven imitation chipped blades or spear points, made of mica-ceous schist, were also taken from the altar, eight of which are shown on the above plate. The lower portion of most of these is perforated for attachment. It is possible that they may have been used as pendants, but, in the opinion of the writer, it seems more probable that they are ceremonial spear points. The surface of each appears to be ground in imitation of the facets upon chipped blades.

Miscellaneous Objects. Only a few remaining objects from this altar are worthy of special mention. Among them are two large

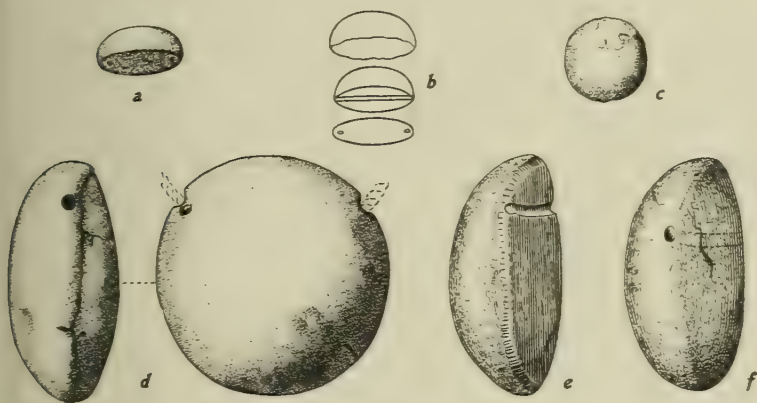


FIGURE 25

a-d, Copper-covered buttons; e, f, Sandstone forms for covering with metal:
a-c, e, f, Altar of Mound 3; d, Mound 4. (About 1/2.)

hemispherical button-like objects of sandstone, which are illustrated in figure 25, e, f. The metal coverings of both are missing. One of the specimens, f, is perforated near its base for the passage of a cord. This perforation is above its center, evidently for the purpose of allowing the ornament to hang properly when attached to the garment, or when suspended against the body. The second example, e, is grooved at one side of the center for the same purpose. The metal plate which covered its base held the cord in place. A third and complete example is illustrated in d. This was found during the excavation of mound 4. It is covered with thin copper plates, the edges of the outer plate overlapping those of the under

one. Similar examples from the Hopewell Group are covered with sheets of native silver.

There are three terra-cotta rings grooved at the outer edge, which were probably used as ear-ornaments. Two of them are of the same type, but are not mates, one being larger and more crudely made than the other. The better example of the two is illustrated in figure 26, a. Several beautifully formed rings of this type, made from the brown micaceous schist called "gold stone" by Squier and Davis, were taken from an altar of the Hopewell Group, and are now in the Field Museum. The largest of these is about $2\frac{1}{2}$ inches in diameter. Similar rings were also found by the above explorers. These stone rings are among the most interesting objects from the mounds. Technically they are perfect; their outlines form true circles, and their surfaces are exactly symmetrical. They could not have been made without some mechanical device based upon the principle of the lathe.¹ The terra-cotta rings, however, are modeled by hand, and afterward baked. Like some of the stone rings, the one illustrated (a) is perforated laterally by eight holes arranged in four pairs. It is not improbable that these perforations were used for attaching feathers or other ornaments placed within or hanging from the central opening. The third terra-cotta ring from this altar is shown in b, the only one of this type recovered.

Several fossils were taken also from the altar, and were probably used as fetishes. They are duplicates of those from the altar of mound 4 which are illustrated in d, plate 17. There were also many fragments of shell vessels, bone and shell rings, and other objects destroyed by breaking or burning.

Intrusive Pit. This was on the eastern side of the mound (2, figure 16), and had been dug to the depth of 7 feet. The clay filling was like the upper strata of the mound, but the layers of stone had been removed. A coating of ash-like substance covered the bottom of the pit, and extended 3 feet up its sides. The extended skeletons of a man and a woman lay upon the bottom near its center. Covering their tibiae were ashes containing bits of burnt bone, both human and animal. Near the skeletons was a flat stone upon which rested a rounded sheet of mica about 12 inches across. About the two skeletons were sixteen crania of

¹ Willoughby, *op. cit.*, Holmes Anniversary Volume, plate 12.

men arranged at regular intervals. Two or three other fragments were also recovered, one of which was part of an infant's skull. When found, the settling of the superincumbent mass of clay had broken, and misplaced some of the bones.

The sixteen skulls were unaccompanied by other bones. They were probably family relics, connected with or belonging to the man whose skeleton occupied the center of the grave. Thirteen of them have superficial scratches or cuts on their surface, apparently made with flint knives in the process of removing the flesh. Some of the skulls had been painted red, and red ocher still adheres to the surface of six. It is more common on the forehead, facial

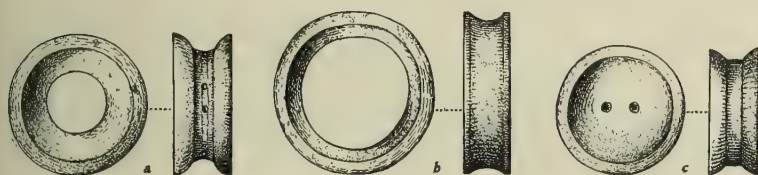


FIGURE 26

Terra-cotta rings, probably ear-ornaments: a, b, Altar of Mound 3; c, Ash-bed, Trench a, embankment of the Great Enclosure. (1/2.)

bones, and jaw, but in one skull it occurs about the base as well, and in this and one other on the temporal fossa. Five of the skulls have one to four perforations, about $\frac{1}{8}$ inch in diameter, in the vault of the cranium. The sixth example has eleven perforations, and another apparently started. This skull is shown in plate 27 together with one having two perforations.¹ The position of the holes seems to indicate that at least a part of them were intended for the passage of a suspending cord. Others may have been used for the insertion of feathers or other decorations.

During the exploration of Marriott mound 1, to the west of the elevated circle (see page 88), a skull was found occupying a small stone-lined grave, and unaccompanied by other bones. This was perforated near the great foramen, probably for the passage of a suspending cord.

Bones coated with red pigment are reported from Ohio by W. K. Moorehead as follows: from a mound at Omega, Ross County; from a Jackson County mound; from two mounds within the

¹ The above description is from the manuscript notes of Cornelia Studley.

corporate limits of Chillicothe; and from a stone-lined grave in Marion County.¹

The following account from Romans of bone painting among the Choctaw throws an interesting sidelight upon these remains.²

The day [of the burial] being come, the friends and relations assemble near the stage, a fire is made, and the respectable operator, after the body is taken down [from the stage on which it has lain for two to four months], with his nails tears the remaining flesh off the bones and throws it with the entrails into the fire, where it is consumed; then he scrapes the bones and burns the scrapings likewise. The head being painted red with vermilion, is, with the rest of the bones, put into a neatly made chest (which for a chief is also made red) and deposited in the loft of a hut built for that purpose, and called 'bone

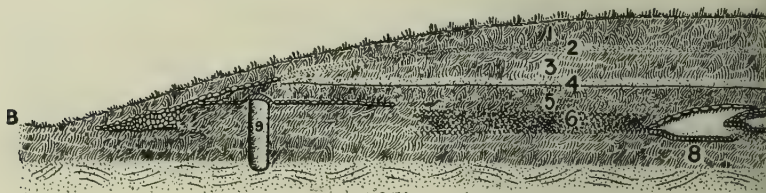


FIGURE 27. Cross-section of Mound 4, looking south: 1, Clay just beneath the sand; 4, Yellow earth; 5, Clay and ashes; 6, Burnt clay; 7, Altar 1; 8, Altar

house.' Each town has one of these. After remaining here one year, or thereabouts, if he be a man of any note, they take the chest down, and in an assembly of relations and friends they weep once more over him, refresh the color of the head, paint the box, and then deposit him to lasting oblivion.

Mound 4. This was approximately 108 feet long by 66 feet wide, with its greatest elevation about 6 feet above the surrounding plain. A cross-section near its center, figure 27, from a drawing by Dr. Metz, shows the following stratification: beneath the thin top-soil were 2 feet of clay (1) resting upon a 7-inch layer of clay mixed with charcoal (2); then came 26 inches of mottled clay (3); an inch of sand, and 7 inches of yellow earth (4); layers of clay and ashes (5); and layers of burnt clay, probably the remains of hearths (6). Three pits with clay covers (9) are shown similar to those in mound 3, but without the accompanying tunnels. Thirteen pits and one hundred and seven post-holes, not shown in the

¹ Alès Hrdlička, *The Painting of Human Bones Among the Indians*, Smithsonian Report, 1904, p. 612.

² *Ibid.*, p. 613.

ground plan, figure 28, are recorded. As it is not possible to plot these with accuracy from the given data they are omitted. Several hearths with cup-shaped depressions were found in the north-western section, and nearly half of the mound area was paved with flat limestones at a point somewhat above the level of the surrounding plain.

At a depth of $5\frac{1}{2}$ feet near the center of the mound, altar 1 (number 7 in plan and section) was encountered. This is described by Dr. Metz in the following words:

The altar was almost quadrangular in form, being a little wider in one direction than in the other. At each corner was a rounded projection. These cor-



top-soil; 2, Clay mixed with charcoal; 3, Mottled clay resting on an inch of 2; 9, Pits covered with clay cone covers.

responded to the cardinal points of the compass. It measured about 6 feet diagonally from corner to corner, and the slope of the sides was 10 inches. Near the southwest side of the floor of the altar was a circular basin, 5 inches deep and 15 inches in diameter. In this were found a copper bracelet, several copper beads, and fragments of mica; a layer of pebbles covered the basin. Nearly the entire floor of the altar was covered with a layer of black ashes, 13 inches deep. Over one side of the floor, and extending nearly to its center was a 2-inch stratum of white ashes (bone ashes?). Over this was a 1-inch layer of black ashes. To the extreme left on the floor of the altar lay a large worked piece of cannel coal, its under surface charred. To the right of the bed of white ashes, and directly in the center of the altar lay a nugget of copper weighing 3 pounds and 10 ounces. Close to this were the fragments of the hollow stone effigy wrapped in pieces of mica. Next to this lay another nugget of copper, beside which were numerous fragments of terra-cotta images of the human form. Over these objects lay a large serpent cut from mica. Numerous copper beads were found throughout the black ashes, above which was a layer of gray ashes, 5 inches deep, containing great quantities of animal remains. These were covered with a layer of worked pieces of cannel coal. Covering the coal and the entire altar was a 5-inch layer of pure sand which was in turn covered by a triple layer of flat stones. These were quite large, and were built over as a covering for the contents of the altar.

After the removal of its contents, a cross-section was made through the altar. Its floor was found to be burned very hard to a depth of $2\frac{1}{2}$ inches, beneath which was a 2-inch stratum of pure clay, and below this 4 inches of red burnt earth. Then came a $1\frac{1}{2}$ inch layer of black ashes, upon which the altar had been built.

Beneath the northeastern edge of this altar (a) a second altar was found, square in form, the edges measuring approximately 4 feet. Its depth was 4

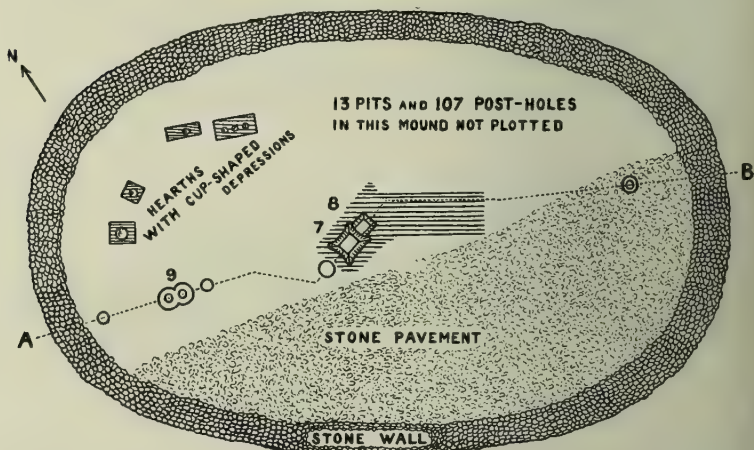


FIGURE 28

Plan of Mound 4: 7, Altar 1, from which many artifacts were taken; 8, Altar 2; 9, Adjoining pits with clay cone covers.

inches, and the inner slope of its side 5 inches. This altar contained only dark ashes.

The relative positions of these altars are shown in figures 27, 28, and 29.

Contents of Altar 1. After removing the ashes and other contents to the Museum, assorting the material and repairing the broken objects, the following specimens were listed: 26 pieces of cannel coal, all but one of which had been laid over the other objects in the altar (plate 17, a); 7 nuggets of native copper, the largest weighing $56\frac{1}{2}$ ounces (c of above plate); a nugget of meteoric iron, weighing $27\frac{1}{4}$ ounces (b); many fossils of various kinds, probably used as fetishes, some of which are shown in d; 284 astragali of deer and elk (e); 44 hollow cones made of antler tips; stones and concretions of natural forms used as fetishes (plate



From Altar 1, Mound 4: a, Cannel coal; b, Meteoric iron; c, Native copper; d, Fossils;
e, Astragali of deer and elk. (1/4.)

18, e); a bracelet, cones, and beads of native copper, and about 200 pearl beads (plate 18, a-d); 2 hollow stone effigies; a representation of the horned serpent cut from mica; and several terracotta figurines. In addition to the above there were many fragments of worked bone, shell, teeth and claws of animals, flint implements, etc. The more important of these specimens will be treated separately.

Meteoric Iron. Reference has been made, page 50, to the objects of this metal from the central altar of mound 3. No artifacts of

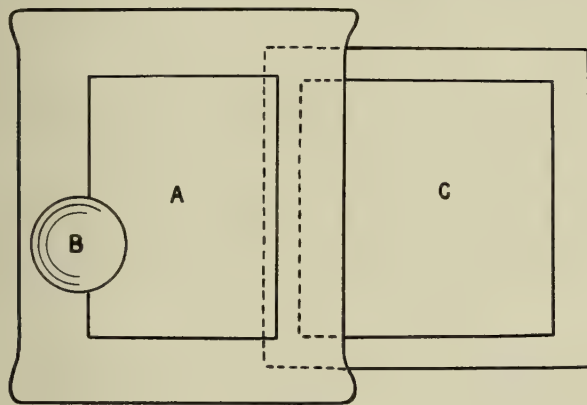


FIGURE 29

Altars of Mound 4: a, Altar 1, with circular basin (b) at one side;
c, Altar 2, partly beneath Altar 1.

this material, however, were found with the nugget from the altar of mound 4. This mass (plate 17, b) taken with the other objects from the ashes, weighed 767.5 grams. The following is an extract from the published account by Dr. Kinnicutt:¹

This mass consisted principally of metallic iron and olivine; the crystals of olivine have a diameter of 5 to 10 millimeters, and are enclosed within the iron. The specific gravity was found by Professor Lattimore of Rochester, New York, to be 4.72.

A section of the stone was made and polished, and the general appearance is shown by the following wood cut. The dark portions showing the size and shape of the crystals of olivine, which were of a dark green weighing from 200

¹ Leonard P. Kinnicutt, op. cit., Reports of Peabody Museum of Am. Arch. and Eth., Vol. III, pp. 382-384.

to 800 milligrammes, had a specific gravity of 3.33. An analysis of the olivine gave the following results:

SiO ₂	40.02 per cent
FeO	14.06 "
MnO	0.10 "
MgO	45.60 "

The iron which enclosed these crystals had a specific gravity of 7.894, and gave by J. Lawrence Smith's process of analyses:

Insoluble residue	00.09
Iron	89.00
Nickel	10.65
Cobalt	00.45
Copper	} Traces
Phosphorus	

A polished surface under the microscope showed, beside the crystals of olivine, small crystals of bronzite, which substance could also be easily detected by reflected light. Small quantities of schreibersite were also undoubtedly present as shown by the traces of phosphorus found in the analysis of the iron.

The specimen belongs to the class of meteorites known as pallasites, and a section of it resembles more closely a section of the Atakama stone than any other known pallasite.

Meteoric iron artifacts have been found in several of the mounds of the Great Earthwork Builders. From the Hopewell Group were taken beads, head-plates, and other ornaments, an adze blade, a drill, and small chisels in antler handles. It is interesting to note that the above chisels are curved and have the form of the upper incisors of the beaver, which were so widely used as cutting tools by the Indians. It seems that in making the chisels of iron they copied the shape of the most effective tool of this nature which they possessed.¹

In addition to the specimens from the central altar of mound 3, there are in the collection of the Museum, several ear-ornaments, buttons, etc., covered with meteoric iron, and an adze blade of this metal, all from the Liberty Group of mounds in Scioto Valley.

Atwater² reports a small sword or large knife completely oxidized, and a plate of iron from the great mound in the center of the circular embankment at Circleville. These were probably

¹ For a drawing of three of these chisels, see Willoughby, op. cit., Holmes Anniversary Volume, plate iv, f.

² Calib Atwater, op. cit., p. 178.



From Altar 1, Mound 4: a, Bracelet of copper; b, Beads of copper; c, Pearl beads; d, Copper cones; e, Stones of natural form used as fetishes. (1/3.)

of meteoric iron. Very naturally these early archaeologists regarded this iron as of European provenience, and as both the specimens were much disintegrated, their original forms or uses were not recognized. The "knife" was accompanied by an antler handle, probably of the same general type as the antler handles of the meteoric iron chisels above referred to, portions of which still adhere to the implements. These meteoric iron chisels are now in the Field Museum of Chicago. Hildreth's and Atwater's misinterpretation of the finds at Marietta, and undoubtedly also of the ones at Circleville, have misled archaeologists for many years as to the antiquity of the mounds of the Great Earthwork Builders. This is also true of certain well-known writers who have done so much to belittle the monumental work of Squier and Davis.

Most of the meteoric iron from the mounds has been worked into tools or ornaments, and it is impossible to tell whether it was all derived from one or several meteorites. If from only one, it would seem to indicate that the Turner, Hopewell, Liberty, and Circleville Groups were contemporary.

Fetishes. Stones and concretions of peculiar shapes, and especially those resembling human or animal forms or any of their parts, were by most Indians supposed to possess supernatural powers, and were used as fetishes. Several of these were taken from the altar, and are illustrated in the lower half of plate 18. The most remarkable of these is the middle stone in the upper row (e), which represents the head of a serpent. Its form has not been modified in the least by art; even the eye is natural. It is very probable that the serpent was the supreme guardian of the owner of the objects sacrificed here, for the mica effigy of the horned deity, illustrated in figures 30 and 31, was also found on this altar. The fossils shown on plate 17, d, were probably also regarded as fetishes.

Mica Objects. A considerable number of designs cut from thin mica had been placed upon the altar, and nearly all were destroyed. Some of them lay in contact with one of the large stone effigies, and were thought by Dr. Metz to have been wrapped around it. A high degree of heat will anneal this mineral, and render it soft, pliable, and easily torn. Practically all of these mica objects owe their destruction to extreme heat. Among the hundreds of fragments were pieces of small scrolls, serpentine

figures, etc., none of which could be joined to form an intelligible design, with the single exception of the horned serpent deity above mentioned. This had been one of the last sacrificial objects to be deposited, and probably owes its fair state of preservation to this fact. Drawings of the greater part of the upper portion of this serpent have been published elsewhere.¹ Since beginning the preparation of this paper, however, the writer has made a careful



FIGURE 30

From Altar 1, Mound 4: Effigy of horned serpent cut from mica. (1/4.)

search among the mica fragments from this altar in hopes of being able to supply at least some of the missing parts, with the good results shown in the photograph. The nose, a part of the upper jaw, the tail with a portion of the rattles, and the lower part of the body were found. The incised lines forming the base of the jaw, the lines about the eye, and the horns on one side of the head, do not show clearly in the photograph, but are brought out in the drawing. There are two perforations for the attachment of the eye, which was undoubtedly a large pearl perforated laterally for

¹ Willoughby, *op. cit.*, Holmes Anniversary Volume, plate ix, m.

the passage of a cord. Such a perforated pearl of a size to fit exactly the two holes in the head was found among the ashes. There seems to be no evidence that the effigy had been painted.

The prominent place occupied by the serpent in the religious life of the Indians is too well known to be enlarged upon here. He was god of the upper regions, the four winds and four quarters, and occurs in combination with the primitive cosmic symbol or some of its parts, from Ohio southward to Central America. He

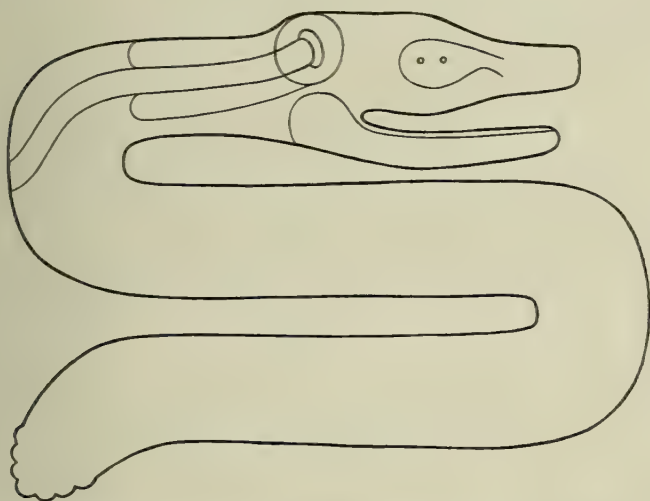


FIGURE 31

From Altar 1, Mound 4: Drawing of the serpent effigy illustrated in figure 30, showing the incised lines outlining the horns, a part of the lower jaw, and the eye, which do not appear clearly in the photograph. (1/4.)

was one of the principal divinities of many North American tribes. Among the Maya and Nahua peoples he was usually shown with plumes instead of horns. The most noted representation of this horned god in the North is the great Serpent Mound of Adams County,¹ which belongs to the same general culture as the Turner, Hopewell, Liberty, and other mound groups. Interesting representations of this serpent were taken from the first three of these groups.

For a description of this effigy, see Willoughby, *The Serpent Mound of Adams County, Ohio*, *American Anthropologist*, Vol. XXI, 1919, pp. 153-163.

Effigies in Stone. A remarkable effigy of a serpent-monster, part horned serpent and part quadruped, beautifully carved in red slate, also from this altar, is illustrated in plate 19, a, b, and a side view is given in figure 32. This was broken into many pieces, most of which were recovered. The head and tail are those of the horned serpent. The latter has the usual rattles. On the head, above and below, appear the typical reptilian plates. Two of the horns are carved in relief, and two are made separately, being inserted in holes drilled at the sides. Drilled holes also form the eye sockets, into which were doubtless inserted pearls, as was usual in the smaller animal effigies of this class. The mouth is open, as shown in the side view. This opening is plain, depressed,

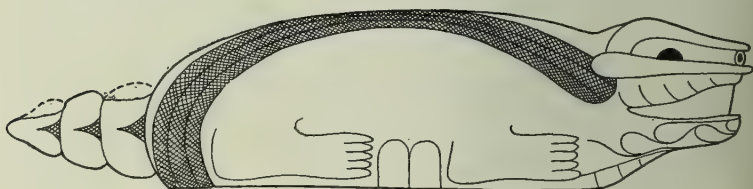


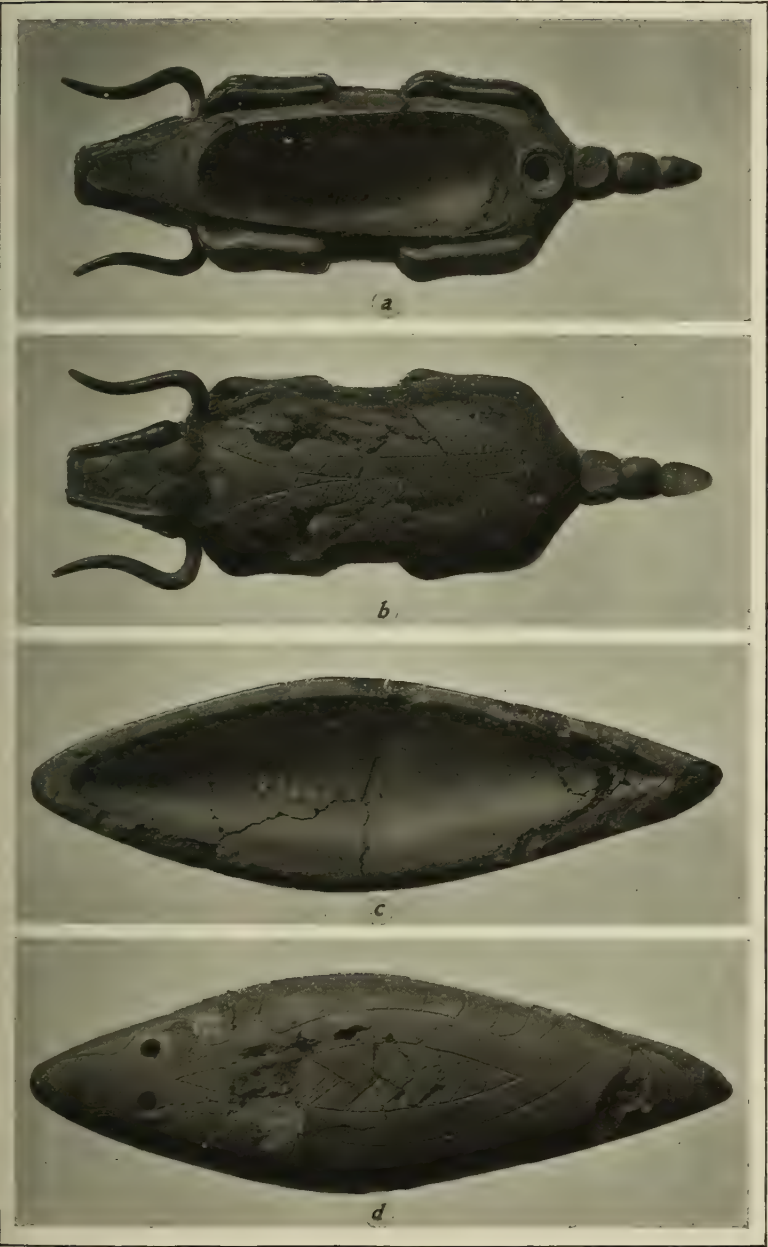
FIGURE 32

From Altar 1, Mound 4: Side view of the horned serpent-monster shown in plate 19, a, b. (2/5.)

and without teeth. It is probable that this depression was originally inlaid with some material representing teeth, for there are two holes drilled upward into each side of the forward portion of the upper jaw beneath the nostrils in which two canine teeth of some small mammal were probably inserted. The body is that of a quadruped, and is ornamented with a decorative band. The vent is pronounced, a feature occasionally noticeable in Indian representations of both birds and quadrupeds, the significance of which is not clear. The effigy probably represents the water-monster or serpent-dragon, a mythical being of the Kiowa and other northern tribes, which is referred to by James Mooney as the "water-monster formed like a horned alligator."¹

The second hollow object from this altar of the same general class is figured in c, and d, of the above plate. Instead of being carved in relief, the animal is represented by the usual lines and cross-hatching seen in the incised carvings upon bone and antler.

¹ Science, March 24, 1905.



From Altar 1, Mound 4: a, b, Horned serpent-monster; c, d, Hollow stone object with incised animal figure. (About 3/8.)

The entire design is illustrated in figure 33. The drawing is so conventionalized we can only guess as to what animal it represents. The eye cavities have an unfinished appearance, and it is probable that pearls were inserted in them. The material is reddish-brown mica-schist thickly interspersed with particles of gold-colored mica. This stone seems to have been highly prized by the Indians, and was used in making various choice artifacts, including the stone earrings referred to on page 60.

These two effigies belong to a group of hollow objects from the mounds, the use of which is unknown. They are usually made of



FIGURE 33

From Altar 1, Mound 4: Incised design upon hollow stone object shown in plate 19, c, d. (2/5.)

choice varieties of stone, but sometimes of antler or other material. They are carved into many shapes, but the more elaborate examples are representations of the upper portion of a bird or quadruped, or the head of some animal. One specimen in the Museum collection is in the form of a large beetle. All of them have a cavity upon the under side, and seem to have been fitted over some object. Some have perforations through the top, evidently for attachment.

Figurines of Terra-cotta. Perhaps the most interesting objects from this altar are the figurines illustrated on plates 20 and 21. There is every reason to believe that the artists who fashioned them belonged to the group of people who resided here, and that the effigies represent individuals or types of the same people. Dr. Hooton has called attention to the fact that the peculiar form

of head shown in the figurines corresponds closely to the crania from the mounds and burial places of this group.

Unfortunately, none of the effigies is perfect. They were either deliberately broken before being placed on the altar, or the heat from the fire caused them to splinter. Probably both agencies contributed to their destruction. Such fragments as could be fitted together have been carefully joined. In this way, the complete outlines of several were restored, as shown in plate 21.

The figures were modeled from clay without the addition of shell. They were apparently roughly formed with the fingers, and finished with modeling tools, some of which had sharp edges for trimming and paring the surface. The ears, ear-ornaments, garments, and some other portions were prepared separately and luted on. So far as can be judged by the fragments, both arms of each individual occupied the same relative position. This is another illustration of the symmetry so characteristic of the art of the Great Earthwork Builders and the Northwest Coast tribes.

Two fragments of similar figures were obtained in the general digging of mound 4, and another fragment was found under the northern embankment of the great enclosure.

These figures have little in common with the crude terra-cotta effigies from other sections of the United States. The modeling is much superior, and an unusual variety of postures is shown. As portraitures of the human form these effigies compare favorably with many of the figurines from the Maya and Nahua regions.

The largest of these effigies (plates 20 and 21, g) represents a man with hands crossed over his abdomen. The face is destroyed, but the shape of the head is easily determined. He wears spool-shaped ear-ornaments of the same form as those of copper taken from the graves and altars of this group. The large knot of hair shown above the forehead in the drawing was among the fragments, and undoubtedly belonged to this figure. He wears a belt, and a broad breech-cloth, which has been painted red.

The greater part of the surface of the effigy shown in a, of both plates, is badly mutilated. This man, also, wears a belt, breech-cloth, and large ear-ornaments. His fore-knot is bound with a fillet which is carried around the back of the head. His foot coverings consist of moccasins with short leggings attached. The upper edge of the legging is scalloped. The moccasin proper has



From Altar 1, Mound 4: Terra-cotta figurines. (About 1/3.)

the U-shaped inset characteristic of the northern Algonquian and neighboring tribes.

The seated figure, f, in both of the above plates, represents a warrior with sides of the head shaved, leaving a ridge of short hair extending across the crown from front to back, a method of arrangement characteristic of the warriors of the Pawnee, Sauc and Fox, and various other tribes of the northern half of the United States.

The kneeling effigy, illustrated in e, has the usual fore-knot, and wears a breech-cloth. The lower legs are flexed, and the toes turned inward, as shown somewhat imperfectly in the rear view. In the seated figure, c, no attempt has been made to restore the head, as the entire outer surface has scaled off.

In the upper row in plate 20 is shown the lower part of a face, and one ear with a large perforation in the lobe. The head is restored in d, plate 21. Detached ornaments were probably inserted in the perforations.

Portions of two other male figures are illustrated in k, plate 20. Both of these wear the usual breech-cloth.

Aside from a few small fragments of one or two individuals, three women are represented in the figurines. The most perfect of these is shown in b, of both plates. This is $6\frac{1}{2}$ inches in height, and represents a matron dressed in a short blanket-skirt, and low foot coverings of the general form of the woven shoes from the Kentucky caves. The hair is neatly parted, and gathered in a chignon at the back of the head. The ears are not pierced. The whole skirt is colored a dull red, and traces of paint may be seen on other portions of the figure. The eyeballs show traces of white, and the lips are colored red. It seems probable that the whole effigy was originally carefully painted. The skirt is short and reaches nearly to the knees. It is of the type worn by the Natchez and other tribes of the South, and is in the form of a long narrow blanket, wrapped around the hips, one corner being tucked in at the waist-line at the back to hold it in place, as shown in the back view in the drawing.

The effigy of another woman is illustrated on plate 20, h. This has been so badly injured that few details can be made out, a considerable portion of the exterior having flaked off. She wears the same type of skirt, but instead of the outer end being brought

around under the right arm before tucking in at the back, it is carried in the opposite direction under the left arm.

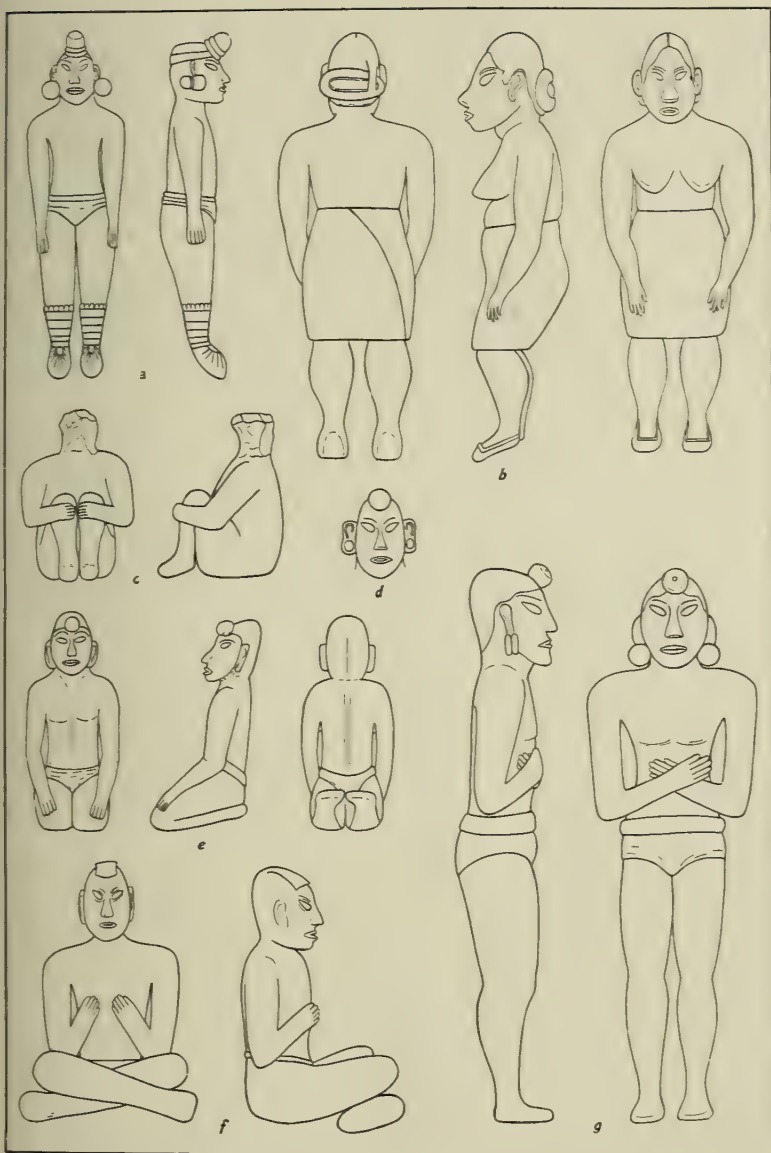
The third woman is represented by a few fragments only. These have been joined together, and are shown in plate 20, i. This apparently was one of the most carefully modeled in the group. It represents a young woman dressed in the characteristic red blanket-skirt, and low shoes, sitting in the usual fashion of Indian squaws, with the lower limbs flexed and the feet carried backward to one side, the weight of the body resting principally upon the lower half of the left leg. The portions of the exterior of the figure which remain show unusual care in modeling and finish. It is possible that these figures when properly arranged may have formed one or more mortuary groups, and the large effigy with crossed hands may have represented a corpse, around which the other figures were placed.

In addition to the objects above described taken from altar 1 of mound 4, there must have been many articles of value such as textile fabrics, objects of wood, dressed skin, etc., which were wholly consumed.

Mound 5. This was a counterpart of mound 6, so far as its outward appearance was concerned. It contained four altars placed near together at different levels. The exploration was begun by digging a trench, 18 feet wide, into the mound from its northwestern end. About 3 feet from the beginning of the trench, at a depth of 6 inches, a skeleton was uncovered lying upon its side in the position indicated in the plan (figure 34). This was undoubtedly an intrusive burial.

Nothing further of note was found until the trench had been carried 21 feet into the mound, when a burnt area near its base, and the edge of altar 1 at a higher level, were discovered. The trench was then extended towards the north, and the altars shown in the plan and section were found. Dr. Metz writes as follows concerning them:

Altar 1 was found at a depth of 41 inches below the surface of the mound measuring to the floor of its basin. The dip of its sides was 12 inches, and the perpendicular depth of the basin, 7 inches. Its length was 3 feet, and its breadth 31 inches. It was filled with sand and gravel, and was covered over with flat stones. Altar 2 was unearthed immediately under the layer of gravel upon which the first altar rested. Its length was 29 inches, its width 19 inches. Its basin, only 3 inches deep, was filled with sand and a dark tenacious earth



From Altar 1, Mound 4: Terra-cotta figurines, with some of the outlines restored.
(About 1/3.)

or clay. Altar 3 was 33 inches long, 27 inches wide, and 6 inches deep. The dip of its sides was 9 inches. Altar 4 was 3 feet long, 2 feet wide, and 4 inches deep, the dip of its sides being 8 inches.

No artifacts were found in any of these altars. The second altar was removed and shipped to the Museum. There was a series of post-holes upon three sides of the group of altars, as shown in the ground plan. There is no mention of these in the notes. Other

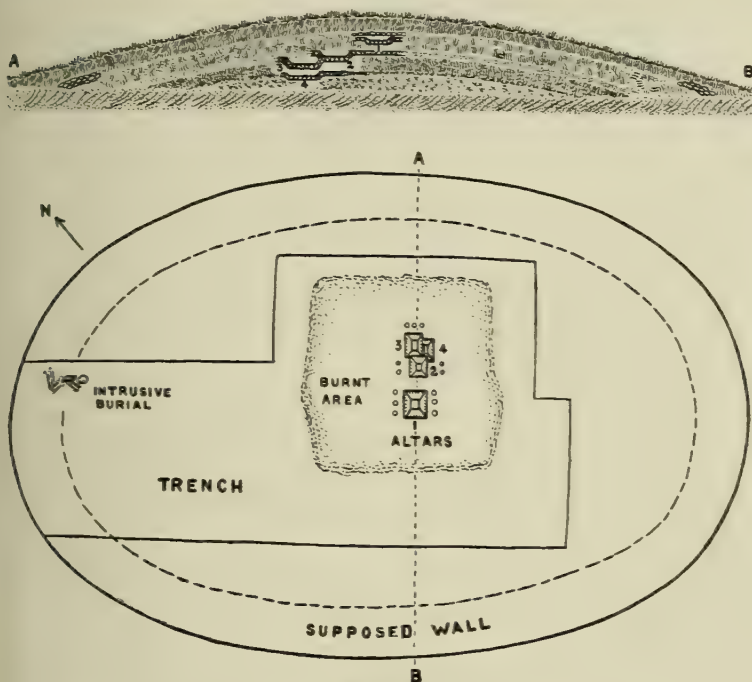


FIGURE 34

Cross-section and plan of Mound 5, showing position of altars.

post-holes may have occurred which were overlooked, or their importance not recognized. There is also no mention of a low wall of river stones such as was found surrounding the other mounds of this connected group. This is probably due to the fact that the mound was not wholly removed during the exploration.

Mound 6. This mound was 66 feet in length by 44 feet in width, measuring from the outer edge of the encircling wall, which con-

tinued in three layers 4 feet up the sides of the mound. Its greatest altitude was 5 feet. The upper portion, to a depth of 2 feet 6 inches, was composed of clay, beneath which was a nearly horizontal layer of gravel, 2 inches thick, its edges touching the upper

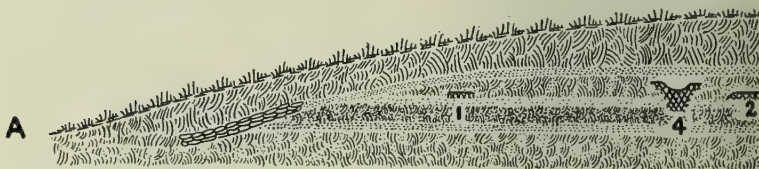


FIGURE 35. Cross-section of Mound 6: 1, 2, 3, Hearths of burnt

layers of the stones forming the encircling wall. Beneath this layer of gravel was a stratum of burnt loam, 8 inches deep, containing the circular altar (4), and hearths (1, 2, 3). The hearths were covered with sand. The one nearest the altar was covered with very fine sand in which were found several animal teeth, perforated. To the southwest from this hearth lay the altar, 2 feet in diameter and 6 inches deep. The sides of its basin were burned to a depth of 3 inches, and the burning extended downward beneath the altar for 12 inches. Some distance to the east, a third hearth was uncovered, measuring 30 by 36 inches. Two distinct burnings had taken place here. In the first, the clay had been burned to a depth of $1\frac{1}{2}$ inches. This had been covered with fresh clay, the upper portion of which was burned to a depth of 2 inches; over this, fine sand was strewn. Beneath the level of the hearths and altars were strata of sand, gravel, and burnt earth.

Beneath the wall, at the eastern side of the mound, were two nearly square pits separated from each other by a clay wall, 4 inches thick. The larger pit was 4 feet long, $3\frac{1}{2}$ feet wide, and 28 inches deep (number 6, figure 35); the smaller was 3 feet square, with a depth of $1\frac{1}{2}$ feet. At one corner of the floor of this pit an oval hole had been dug to a depth of about a foot. These pits were filled with river sand in which were numerous small fresh water shells.

Post-holes to the number of one hundred and three were found, and plotted on Dr. Metz's plan, many of which were beneath the surrounding wall.

Mound 7. This mound, with its periphery touching the edges of mounds 3, 4, 5, and 6, is one of the smallest of the connected group. It was 40 feet in diameter, and a little over 5 feet in height. Near its base, at the same level as the surrounding plain, was the



clay; 4, Circular altar; 5, Post-holes; 6, Pit beneath wall.

burnt area of irregular form indicated in the ground plan, figure 37. A circular depression or hearth was found near the stake marking the center of the mound (number 8). A few feet to the west was

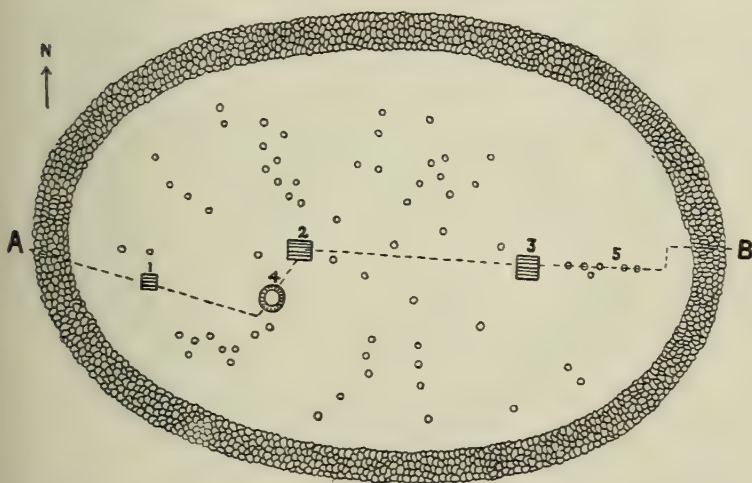


FIGURE 36

Plan of Mound 6: 1, 2, 3, Hearths of burnt clay; 4, Circular altar; 5, Post-holes.

a circular basin (9), 4 inches deep, filled with ashes and covered with clay. The altar (7), found 4 feet east of the central stake, was 3 feet long, and 28 inches wide. This was taken out and shipped to the Museum. Beneath it were indications of a second

altar. A few pits and numerous post-holes found at the base of the mound are shown on the plan prepared by Dr. Metz. The only artifact found was a copper ring, about a foot from the surface.

Mound 8. At the foot of the graded way, there is a small earth-work enclosure still showing a very shallow ditch on its inner side.

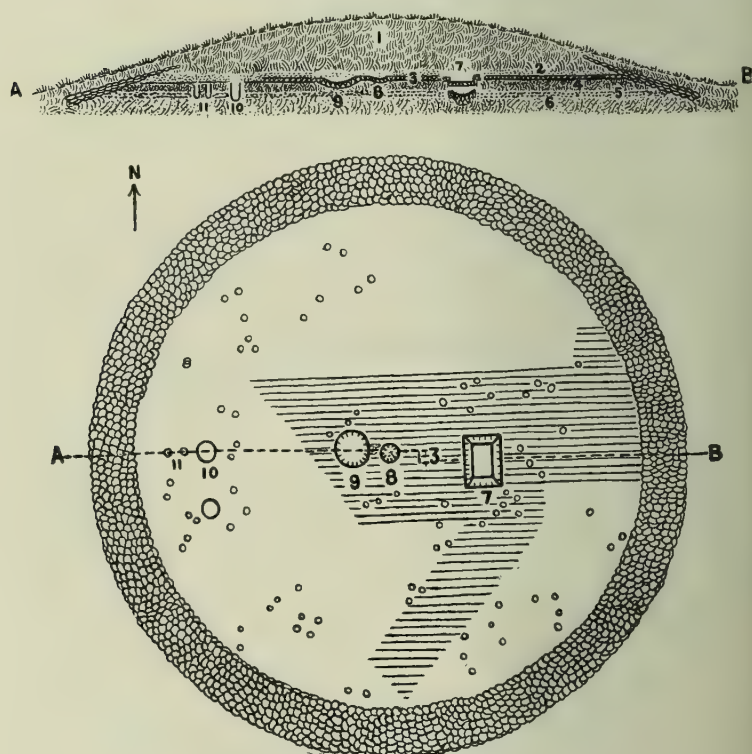


FIGURE 37

Cross-section and plan of Mound 7: 1, Mixed clay and earth; 2, Gravel; 3, Burnt area; 4, Clay and charcoal; 5, Black earth; 6, Hard-pan; 7, Altar; 8, Circular depression; 9, Circular basin; 10, Pit; 11, Post-holes.

This enclosure is approximately 100 feet in diameter, with gate-way opening to the east. The height of the embankment is about 10 inches. Within this is mound 8, having a height of 30 inches. Dr. Metz writes as follows:

A trench 15 feet wide was carried directly through from north to south, which was the longest diameter of the mound. Many stones were uncovered, which had probably been torn up by the plow. Mr. Turner informed me that he had carted away six wagon loads.

On reaching a depth of 10 inches, a pavement of flat river stones was uncovered which extended 25 feet north and south, and had a width of 12 feet throughout. This pavement was laid upon a layer of black soil, 5 inches deep. No traces of ashes or charcoal were found. Below this black soil was the clayey loam of the surrounding plain.

In 1905, Mr. Volk uncovered and photographed a portion of this, or a similar pavement within the earth circle. His description follows:

Dug trenches west of the many stones strewn over the surface. It was found that they had been arranged in layers 10 to 12 inches below the surface They were water-worn pebbles of fossiliferous limestones about 6 to 12 inches in length, by 4 to 8 inches in width, the thickness varying from 2 to 4 inches. There were four layers of stones near the center of the pavement, but at the edges they dwindled to a single layer. In removing the stones I found about a dozen that had been burned. Several of the pebbles were notched, and some of the thin ones showed chipping to a cutting edge. These may have served as diggers in excavating the tough clayey soil of the locality.

Mound 9. This mound was about 60 feet in diameter, and 5 feet high, and was outlined with the usual layer of stones. From the surface downward the strata were as follows: clay similar to that of the ordinary surface of the plain, 16 inches; clay containing numerous traces of charcoal, 18 inches; a layer of flat stones, 15 feet wide and 25 feet long, occupying the center of the mound; from the edges of the stone layer, a stratum of coarse gravel 3 inches thick extended to the mound's outer edge; and beneath the layer of stones was a thin stratum of sand which covered a layer of flat ashes under which the earth was tinged red by burning.

To the west of the center of the mound and beneath the layer of stones, an altar, 4 feet long and 2 feet wide, was found. Its basin was 4 inches deep, with sloping sides 10 inches wide (number 1 of figures 38 and 39). The altar was filled with fine sand covered with coarse gravel. Its floor was burned to a depth of 5 inches. Nine feet east of the altar, at a lower level, a nearly circular basin or altar was uncovered (number 2), the bowl-shaped cavity of which was 8 inches deep, and 3 feet across at the top. Its floor was burned to a depth of 5 inches. The cavity was filled

with a dark, very tenacious earth. No artifacts, with the exception of the usual flint chips and potsherds scattered through the mound, were obtained. At the base of the mound numerous pits



FIGURE 38. Cross-section of Mound 9:

or post-holes, 12 to 24 inches deep, and 6 to 10 inches in diameter, were found.

Mound 10. This is situated just north of the small enclosure at the foot of the graded way. It was oblong in shape, about 3 feet high, and extended east and west approximately 40 feet.

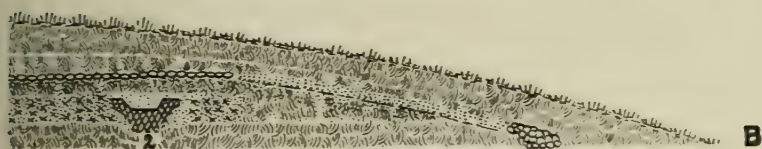
A trench 18 feet wide was dug through its longest diameter. The mound was composed of sandy loam showing traces of charcoal throughout. At its center, and on a level with the plain, was found an ash-pit which was carefully explored. The contents were as follows, working downward: 7 inches of black ashes; 16 inches of gravel, sand, and ashes; and at the bottom, 4 inches of pure ashes. The diameter of the pit at its top was 6 feet; at its bottom, 16 inches; and its depth was 27 inches. Scattered throughout the ashes, sand, and gravel were animal bones, fragments of pottery, mica, and charcoal.

Mound 11. Within the great enclosure and about 300 feet northeast of mound 10 is situated this tumulus. Excavations showed it to be composed of sandy loam having a mottled appearance. No traces of charcoal or ashes were discovered.

In the center, and at a depth of only 8 inches, a skeleton was unearthed in a horizontal position, head to the south. The right hand was placed over the pelvis, and contained a small copper adze blade [figure 44, c]. About 4 inches from the skull a mass of galena, weighing one pound and six ounces, was found. Three feet southeast of this skeleton lay the remains of a child in a doubled-up position; and 5 feet southwest of this, and 16 inches beneath the surface, was a second adult skeleton in a horizontal position with its head to the south. Near the left hip was a broken pottery vessel, and near by a flint knife. [This vessel is shown with outline restored in plate 22, d.]

Mound 12. This interesting earthwork, the larger of the two mounds in the elevated circle, was 52 feet in diameter, and some-

what more than 5 feet high. After working through a stratum of clayey loam, $2\frac{1}{2}$ feet in depth, Dr. Metz came upon a horizontal pavement of flat river stones, 25 feet in diameter, having a cir-



1, Altar; 2, Circular basin.

cular outline (2, figure 40). This was about 3 feet above the base of the mound. Dr. Metz's account is as follows:

This pavement was laid on a 3-inch stratum of sand. On removing the stones and sand, a circular stone wall was discovered, and within the enclosure

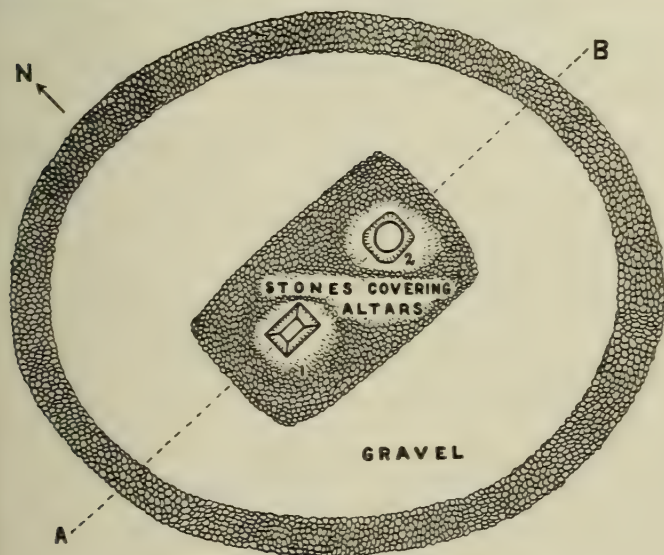


FIGURE 39

Plan of Mound 9: 1, Altar; 2, Circular basin.

formed by this wall was a mass of round, drift-gravel pebbles ranging in size from a filbert to an orange. These pebbles covered an earth mound within the wall, which was 2 feet 4 inches in height, and had a base diameter of 12 feet. The earth composing this little mound was stratified, there being several

alternate layers of dark earth and yellow clay, the latter being much the thicker. In the dark earth strata, traces of charcoal and ashes were seen.

The circular wall [see ground plan and cross-section, figures 40, 41] was 34 inches in height, 30 inches wide at its base, and 24 inches at its top. It rested on a 4-inch layer of coarse gravel which connected with the gravel surrounding the central earth mound. The diameter of the enclosure within the wall was 21 feet.

Not far from the center of the small interior mound, and beneath the stratum of coarse gravel, was a 3-inch layer of fine sand which covered a small altar (8). The basin of the altar was 2 feet in length, 18 inches in width, and had a depth at the sides of 6 inches.



FIGURE 40. Cross-section of Mound 12: 1, Clayey loam; 2, Layer earth and yellow clay; 6, Pebbles; 7, Sand; 8, Altar; 9, Cavity

Its cavity was 4 inches deep, and contained slightly burnt earth. The floor of the altar was burned to a depth of 3 inches, its entire thickness. Continuing, Dr. Metz says:

On removing the altar, a cavity filled with fine sand was discovered beneath. The length of this cavity was 12 inches, width 10 inches. A single valve of a unio shell was found in the sand contained in the cavity. It was placed directly under the floor of the altar, and lay upon the sand. On removing the sand, the depth of the cavity was found to be 8 inches.

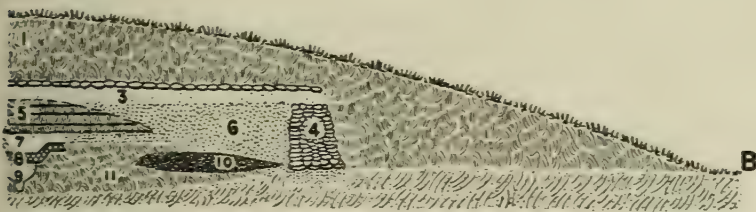
This cavity or basin [number 9 of the cross-section], was moulded in the clay upon which the altar rested. The imprints of the fingers of the ancient workmen were plainly visible upon its sides and bottom. Its form somewhat resembled the impression of a human foot clothed with a moccasins.

To the northwest of the altar at a distance of 30 inches was an irregular layer of dark, tenacious clay (10), having a depth of 4 inches, and extending several feet in width and length. It showed no evidence of having been burned.

The circular stone wall was built principally of large river stones with occasional large limestones interspersed, some of them being 12 inches in length and width, and 3 to 5 inches in thickness. A portion of this wall is shown in the photograph, figure 42. The

spaces between the stones were packed with sand and gravel. The inner edge of the wall was perpendicular. The outer edge sloped inward gradually from its base to its top (4, figure 40). The wall formed nearly an exact circle, and was uniform throughout except on the southwest side, where it had been disturbed by two burials, at least one of which was probably intrusive.

From the inner side of the southern portion of the wall, a single layer of stones extended to the south corner of the altar. Above this row of stones, and supported by the layer of gravel extending under the small interior mound, was a second line of stones reaching to the edge of this inner mound. On the



of stones; 3, Sand; 4, Circular wall; 5, Alternate layers of dark beneath altar; 10, Dark clay; 11, Clay.

southwest side of the wall, three courses of stones had been removed for a distance of 4 feet, and in the space thus formed, and on a stratum of fine sand, 26 inches below the surface, the flexed skeleton of an adult was found [figure 41, a], the bones of which were much decayed, and the skull in fragments.

On the west side, the wall was again interrupted. For a space of 7 feet, five courses of stone had been removed, and an adult skeleton [b] in a horizontal position resting on a bed of coarse gravel was unearthed. Near the knees lay portions of a large marine shell. The stones which had evidently been removed to make way for the two interments were not found.

Just outside the wall in the western portion of the mound were two skeletons lying side by side in a horizontal position, heads to the north. The one nearer the wall (c) was evidently an adult male; the other (d), a youth. At each hand of the former lay a copper spool-shaped ear-ornament. At the left hand of skeleton d, rested another copper ear-ornament, and at intervals along the right arm were several shell beads. At the right hand were a considerable number of shell beads, and near the pelvis a portion of a second ear-ornament. A large shell vessel, with its smaller end

downward, rested near the head. Four canine teeth of the bear, perforated for attachment, were also found with this skeleton.

Continuing the excavations to the southward outside the wall, several additional burials were uncovered.

Skeleton e, of an adult, was found in a flexed position about 10 inches from the wall. It was badly decayed, and the skull was in fragments. An adult skeleton [f], 8 feet to the southeast, was also in a flexed position, 3 feet from

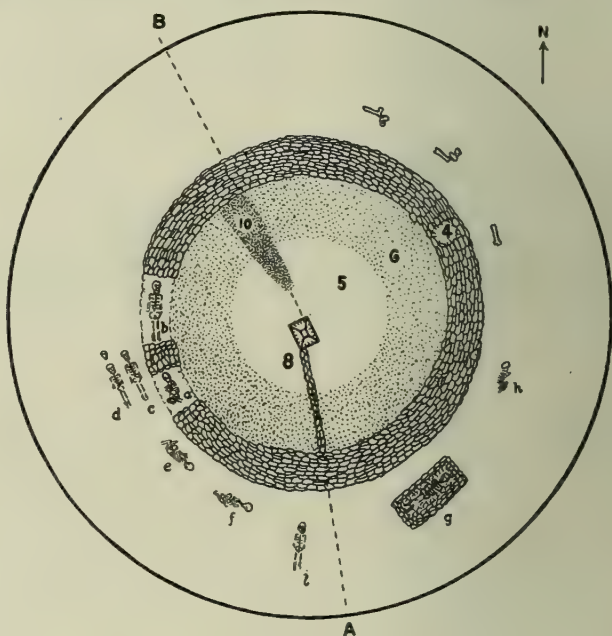


FIGURE 41

Plan of Mound 12: a-i, Graves containing skeletons; 4, Circular wall; 5, Small interior mound; 6, Pebbles; 8, Altar; 10, Dark clay.

the surface. Skeleton g, of an adult, lay in a horizontal position, head to the northeast, on a pavement of flat stones, 7 feet long and 3 feet wide. A copper ear-ornament lay at each hand, and a copper blade [figure 44, a], at the right shoulder; at the neck and shoulder were many shell beads. An adult skeleton [h] in a flexed position, a few feet northeast of the latter, and 3 feet from the surface, was much decayed. No artifacts were found with it. Skeleton i, an adult, 4 feet to the south of the wall, at a depth of 2 feet, lay on a bed of coarse gravel, 4 inches in thickness. A plate of mica rested at the neck and shoulder.

To the northeast of the wall at three different points, portions of skeletons were unearthed. At one place, a right femur and part of a pelvis, and at a distance of 4 feet a left femur and part of another pelvis were found. At a point 6 feet to the south was a single femur, unaccompanied by other bones.

With all the skeletons occupying a horizontal position, relics were recovered, and great care seems to have been taken in their interment, as they were placed either on a bed of sand, gravel, or flat stones. While with those that were interred in a doubled-up position, no relics were found, nor was there evidence of special care being exercised in their burial. We failed to discover a single potsherd or a flint chip in the entire mound.

The earth composing the greater part of the mound seems to have been taken from the surrounding plain. It was homogeneous throughout. Upon



FIGURE 42

Section of Mound 12 showing circular wall.

the slope of the tumulus were several stumps, one of which, an oak, measured 12 feet in circumference.

Mound 13. This is the smaller of the two mounds in the elevated circle. It was approximately 30 feet in diameter, and 2 feet high. Upon removing the earth, a circular pavement of flat river stones, 15 feet in diameter, was found. This rested on a layer of sand, 8 inches deep. The clay beneath the sand showed no evidence of having been disturbed.

Mound 14. This is the smallest and the most northern of the seven connected mounds within the great enclosure. It was ap-

proximately 30 feet in diameter, and had been reduced to a height of but 2 feet. Only a portion of the surrounding wall remained, most of it having undoubtedly been destroyed by plowing. Near its center was unearthed a small square altar of burnt clay, 28 inches in diameter. The depth of its basin was 7 inches, and the slope of its sides, 9 inches. The stratum above the altar was clean gravel, having a thickness of 8 inches, upon which rested a 12 inch layer of soil. The basin of the altar was filled with yellow clay.

Mound 15. Upon the river bank, about 900 feet north of the great enclosure, is a mound, the greater part of which has been

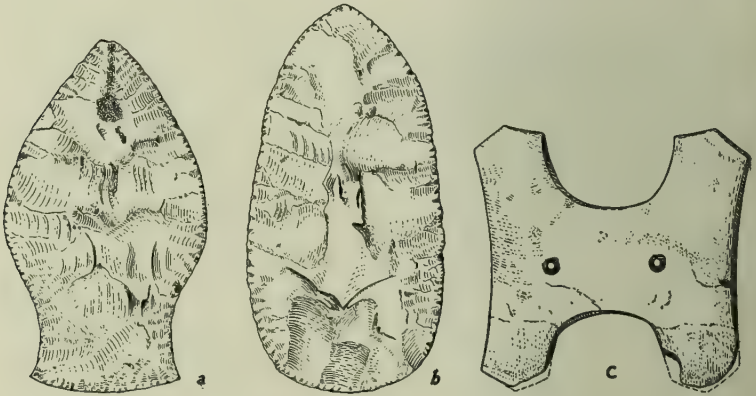


FIGURE 43

Chipped knife blades and a gorget, taken with others from a cache in Mound 15.
(About 1/2.)

destroyed by the washing away of the bank during freshets. The dimensions of the remaining portion as given by Dr. Metz are as follows: height 6 feet, diameter 25 feet, length 65 feet. Its surface was originally paved with round pebbles which seem to have been carefully selected both as to size and color. They average a little larger than a goose egg, and are of a bluish shade. They were compactly laid, resembling in this respect the pebble pavements of modern streets. The center of the mound was composed largely of kitchen refuse to the height of about 3 feet, over which had been placed a 2-inch stratum of sand. This, in turn, had been covered with about 10 inches of hard dark earth. The re-

maining portion was made up principally of clayey loam, and gravel. A few small hearths of river stones were found also.

Animal bones, potsherds, broken implements, flint flakes, pieces of mica, etc., were common. About twenty-five calcite gorgets (so-called) of the form shown in figure 43, c, several of which were broken, were taken from a cache in this mound. With them were seven thin, finely chipped blades, of the type figured in a, and one leaf-shaped blade, b, of the above figure. These

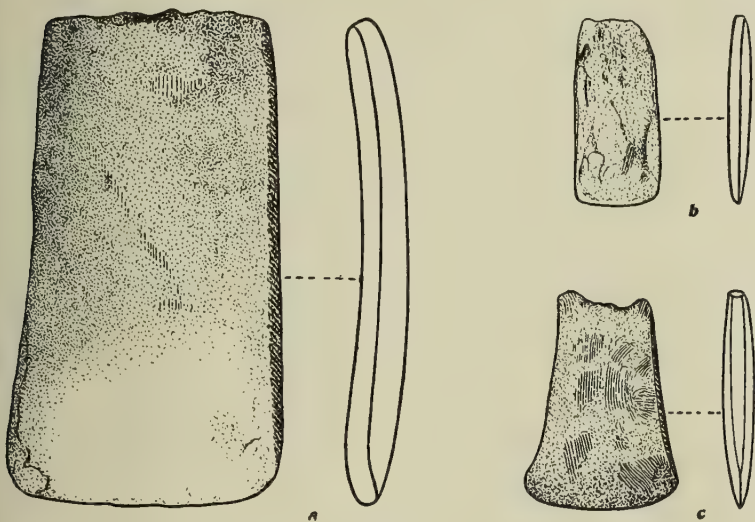


FIGURE 44

Copper blades from graves: a, With Skeleton 7, Mound 12; b, Grave 5, Burial Place e; c, With skeleton of child, Mound 11. (2/3.)

were found with pieces of worked antler, probably the remains of their handles.

Mounds to the West of Elevated Circle. The largest of these, Marriott mound 1, was opened in 1884 by Dr. Metz and Professor Putnam, and an account of the exploration was published.¹

At the time of the exploration the mound was 2 feet high, and 60 feet in diameter. Its height had been reduced by plowing, and the layer of stones which had covered the lower portion had been

¹ F. W. Putnam, *The Marriott Mound No. 1 and Its Contents*, Reports of the Peabody Museum of Am. Arch. and Eth., Vol. III, pp. 449-466.

disturbed. Near its center was a rude altar or basin of clay which contained ashes, charcoal, burnt acorns, and pieces of burnt bones, some of which were probably fragments of implements. There were also several beads of shell, and other ornaments. Near the altar were two hearths or areas of burnt clay and stones, 8 to 10 inches in depth. Several bone implements, flaked knives, etc., were found in the ashes.

Near the center of the mound was a group of four graves, each outlined with flat limestones. The largest of these graves contained a skeleton lying at length, head to the northeast. The smallest contained a complete skull with under jaw. A hole $\frac{1}{4}$ inch in diameter had been bored through the occipital bone, near the margin of the foramen magnum. The position of the holes suggests that a cord, for the purpose of suspension, may have been passed through it and out of the great foramen. Two other small graves were nearby, each containing a skeleton out of natural order.

A plate of native copper, ear-ornaments of this metal, perforated teeth of the bear, two of them inlaid with a large pearl, many pearl beads, and various implements were found with the skeletons.

The construction of the mound, the forms of the graves and the artifacts, all indicate that this was probably contemporary with the other earthworks of the group.

Some 400 feet to the northeast of the above tumulus is Marriott mound 2, much reduced by cultivation. This proved of little interest. About the same distance to the southeast, and occupying one of the points of the triangle formed by the three tumuli, is Cemetery mound, so-called because it is located in a private cemetery. This has never been explored. Still farther to the west are the remains of a small mound which has been destroyed.

ARTIFACTS IN GENERAL

Stone Implements. Comparatively few stone implements were found. A few dozen chipped flint knives of common forms, such as can be picked up on almost any site, several chipped flint scrapers, and a few grinding stones, hammer-stones, and anvils were obtained during the general digging. No chipped flint arrowpoints occurred, which is especially remarkable considering

the hundreds found at the Madisonville site, only a few miles distant. There were no "snub-nose" scrapers, which were also common at Madisonville. By far the most abundant flint implement is the flaked knife, figure 10, a. Scores of these were recovered, usually from graves but many were found in general digging. Only three or four stone adze blades were collected. One of these accompanied an intrusive burial. The others were found under conditions which render it doubtful if they were left by the Earthwork Builders.

There were no grooved axes and but few of the grooveless variety; only two of the latter were recovered under conditions which

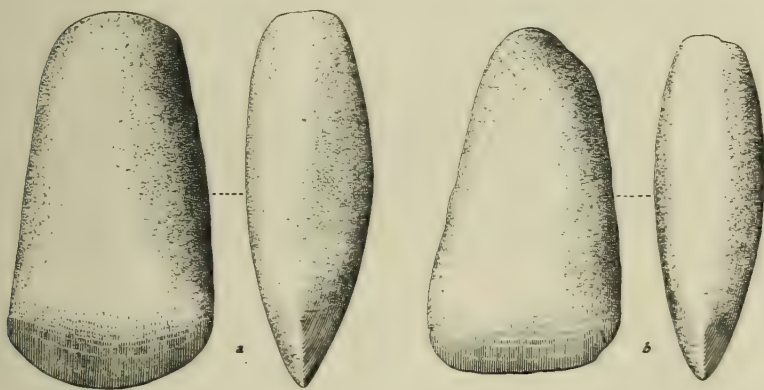


FIGURE 45

Stone axe blades from post-holes: a, Mound 5; b, Mound 4. (1/2.)

render it certain that they belonged to the people under consideration. These are illustrated in figure 45, and are both from post-holes. One of them (a) is from mound 5, the other from mound 4.

Implements of copper seemed to be confined to adze blades, and awls or pins. Three of the former are shown in figure 44, all from graves.

Textile Fabrics. Numerous small fragments of twined-woven cloth, preserved by salts of copper, were adhering to a few ear-ornaments and other objects of this metal from certain graves. They all seem to be of the variety shown enlarged in figure 46, which was common over a wide area. Other types of twined and checker weaving, such as were taken from the Hopewell, Liberty,

and other mound groups, were doubtless also made and used by the people who occupied this site.

Pottery. During the exploration of this group of earthworks, two to three bushels of potsherds were recovered. These were found principally in the refuse piles, in the general digging of the mounds, on the hearths, and among the ashes of the mounds and embankments. Sherds were found with several burials, but only two of these vessels could be restored. They are shown on plate 7, c, and plate 22, d. Not one fragment of pottery of the Madisonville type was found. Pots with ears were apparently unknown to the builders of these earthworks.¹

A most instructive group of vessels taken from the hearth near the center of mound 1 (figures 12 and 13) is illustrated in plate 23,

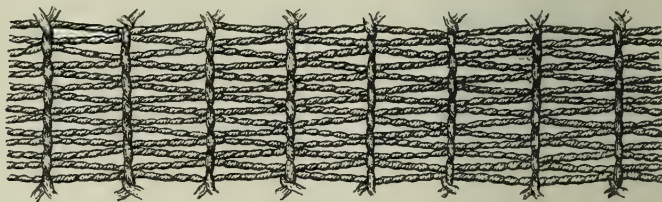


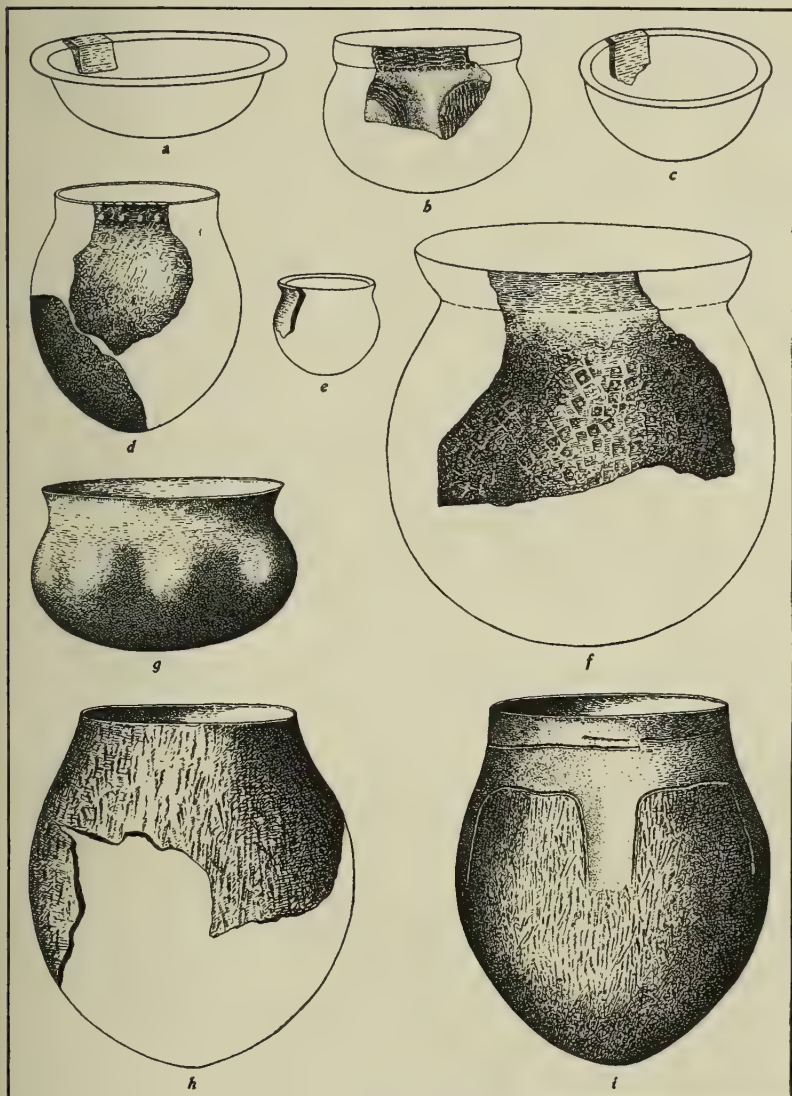
FIGURE 46

Cloth enlarged three diameters to show type of weaving. Contact with copper ear-ornaments had preserved a few pieces of this twined-woven fabric.

and in g, h, i, plate 22. The four vessels represent types in use at the same period, and as good fortune will have it, they belong to the three principal groups of pottery from this site.

The two examples figured at the bottom of plate 22 are ordinary cooking pots. Like most of the coarser pottery from this site, they are made of clay, sparingly tempered with crushed stone. The greater portion of the surface of each is covered with cord markings, produced probably by the twine-covered potter's paddle used in their construction. The upper portion of the body of i, is separated into four divisions by somewhat depressed bands extending downward from the roughly smoothed neck. A smaller pot with similar decorations, from a mound in Wisconsin, is

¹ For examples of Madisonville pottery, see *Indian Village Site and Cemetery Near Madisonville, Ohio*, Papers of the Peabody Museum, Vol. VIII, No. 1, plates 22-24.



Pottery vessels: a, e, Mound 4, general digging; b, f, Burial Place, general digging; c, Trench a, embankment of the Great Enclosure; g, h, i, Central fireplace of Mound 1. (About 1/5.)

figured by Holmes.¹ Probably two-thirds of the potsherds from the Turner Group are of this crude variety, without decoration except occasionally at the neck or near the rim, as illustrated in plate 22, d, and plate 24, d-f, j, k, and having the usual cord markings. In figure 47, a, c, are shown outlines of two of the largest, each restored from a single fragment of the rim and part of the body. The approximate capacity of each is twelve to fifteen gallons.

The third and fourth vessels from the hearth of mound 1, although of entirely different shape, evidently belong to the same general group. The first of these is shown in plate 22, g. It is made of the same material as the others, is shallow, with rounded



FIGURE 47

Outlines of large cooking pots restored from fragments. The approximate capacity of the two largest is twelve to fifteen gallons.

bottom, and the body has six lobes. Unlike other vessels of this shape it has no surface decorations. A second example of this type with four lobes, and bearing characteristic surface decorations, is illustrated in b. Fragments of a number of this general form were found. The fourth vessel from the hearth is figured on plate 23. It is nearly cylindrical, with flat bottom, and is ornamented with angular bands filled with the usual zigzag pattern.

Many fragments of ware bearing this type of decoration were recovered. They were not, however, nearly so abundant as the cord-marked group above referred to. Pottery vessels with this style of decoration were made in a great variety of shapes. The designs were usually composed of bands or circles outlined with in-

¹ *Aboriginal Pottery of the Eastern United States*, W. H. Holmes, Twentieth Report, Bureau of American Ethnology, plate clxx, b.

cised lines, and filled with zigzag patterns which were not made with a roulette, as suggested by Holmes, but with a tool more or less gouge-shaped, having a plain or notched edge, which was pressed against the soft clay with a rocking motion, each opposite corner being raised and slightly advanced alternately, the tool not being wholly lifted from the vessel. Potsherds showing these markings were found in nearly all the mounds of the group, also in the cemetery, and beneath the embankment of the great enclosure. Examples are illustrated on plate 24, j-l, n-p. While most of the sherds of this general class have the zigzag pattern as a part of the decoration, it is replaced in a few instances by circular or square depressions, the former being shown in m. Another vessel having the zigzag pattern over nearly its entire surface is illustrated in plate 7, c. It was found in grave 9-b, in the cemetery of the great enclosure by Mr. Saville in 1890.

A portion of a very interesting vase, about 6 inches in height, from the Liberty Group of mounds, is in the Museum collections. It is of a depressed double globular form. The entire lower section is covered with a design composed of triangles made up of bands $\frac{3}{8}$ of an inch wide, filled with zigzag markings. The upper section is somewhat smaller than the lower, and is ornamented with a zone in which are six highly conventionalized bird figures, the space within the incised outlines of each bird being filled with the usual zigzag pattern. Each alternate bird is reversed. Both the figures and grouping remind one strongly of similar designs upon Peruvian textiles. Illustrations of a few examples of this group of earthenware taken from the mounds of the Great Earthwork Builders in Ohio, Indiana, and Michigan, are brought together by Holmes, and should be compared with those described in this paper.¹

Squier and Davis found a number of these vessels on the altar of mound 3 in Mound City, two of which they figured; and a flat-bottomed vase, closely resembling in form a modern terra-cotta flower pot, with its outer surface covered with zigzag markings, was taken from the altar of the great mound of the Hopewell Group. Many fragments of vessels having a cross-hatched band near the rim, beneath which was usually an encircling row of dots or depressions, were found. These apparently belong to the same

¹ Holmes, *ibid.*, figure 74 and plates clxix, clxxi, clxxii.



Pottery vessel from central fireplace of Mound 1.
(About 1/2.)

general group as the above, for the forms and material are the same, although the ornamentation differs in detail.

In addition to these there are fragments of vessels with flat bases, and upright or flaring sides. A nearly perfect specimen of the former kind has already been referred to (plate 23). There is also shown on plate 24, r, the bottom of a vase having four feet. Ten feet of similar vessels were found during the explorations of mounds 3 and 4, and beneath the embankment of the great enclosure. Sherds of various food bowls, with wide rims and without decorations, were recovered (plate 22, a, c, and plate 24, h); and also a very few fragments showing ornamental paddle marks, the largest of which, with the form of the pot restored, is illustrated in plate 22, f. A small fragment having a more elaborate pattern may be seen in plate 24, q. There were also several sherds similar to s, of the same plate. Sherds showing ornamental paddle marks were extremely rare. Such vessels may have been brought from the southern Appalachian region, or they may possibly have been made by captured women from the South.

Some of the clay used in making the smaller and more delicate vessels was tempered with sand instead of crushed stone. The writer has found no evidence of the use of crushed shell as a tempering material by the builders of these earthworks, as was the custom among the later Indians of the neighboring Madisonville site.

The pottery of the builders of this mound group shows a great variety of form, size, and decoration. The patterns upon some of the sherds, although more crude, seem to belong to the same general class as the designs upon the hollow stone effigies illustrated on plate 19. There can be little doubt that if the explorations of the Hopewell, Mound City, Liberty, and other well-known sites of southern Ohio had been as prolonged and as carefully conducted as those of the Turner Group, an equal number and variety of potsherds would have been found.

Mr. Holmes was the first to recognize that the few known vases and sherds, bearing the characteristic zigzag ornamentation above described, which were obtained from the mound area of the states bordering Ohio, should be attributed to the Great Earthwork Builders, whose center of development was in the southern portion of that state.

Mr. Holmes writes as follows:¹

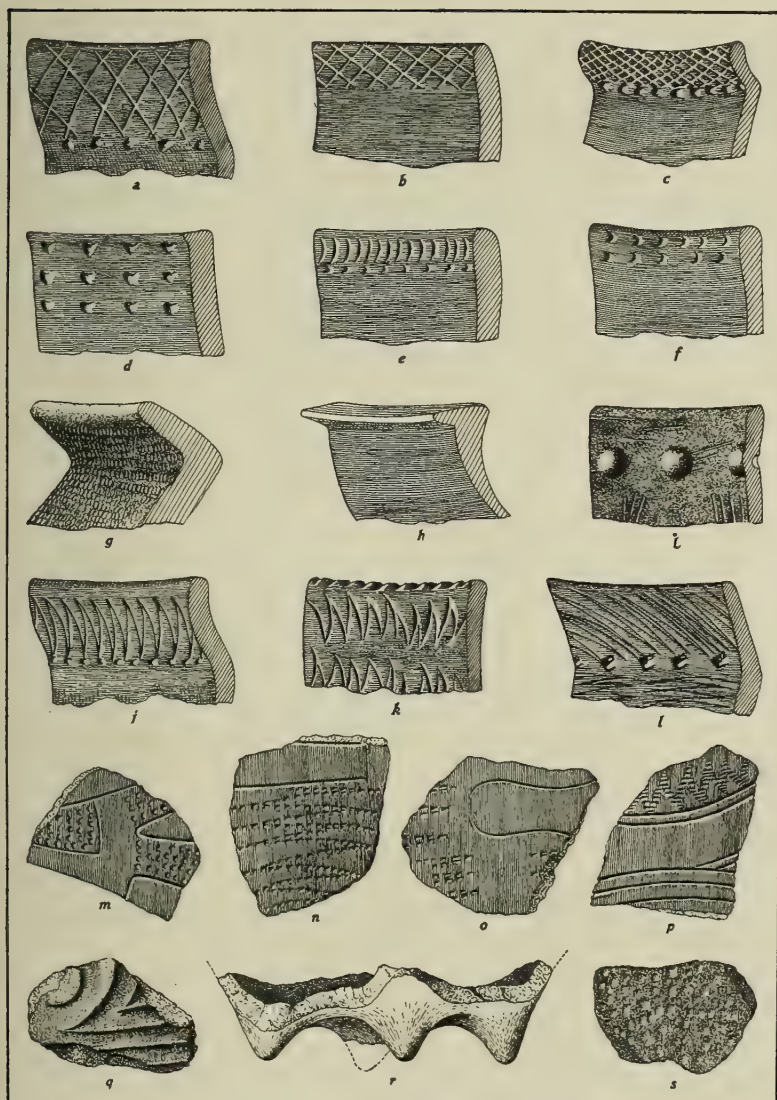
It would seem that the builders of the great mound groups about Chillicothe, the enterprising people who gathered stores of shells from the Atlantic, copper from Lake Superior, flint from the lower Ohio Valley, and obsidian from the Rocky Mountains, Oregon, or Mexico, were identical with or closely related to tribes scattered over a large part of a region including parts of Ohio, Indiana, Illinois, Iowa, Michigan, and Wisconsin. Though the pottery of this group of people is not nearly so highly developed as is that of the southern mound-builders, as for example those of Cahokia in Illinois, and of Etowah in Georgia, there can be little doubt that their general culture was of an order equally advanced.

With respect to the origin of the great numbers of obsidian implements found in the Hopewell mounds, it may be well to note that there is no trace of Mexican characters in the pottery of these mounds; besides, the general trend of the group of ware here associated is from Chillicothe toward the northwest, suggesting the upper Missouri region or the valley of the Columbia as the source of the obsidian. The significance of this observation is emphasized by the discovery of fragments of rouletted ware in the Yellowstone National Park, where great beds of obsidian are found. . . . These fragments were brought in by Colonel P. W. Norris, Superintendent of the Park, in 1880. They represent a large jar or pot with upright neck. The material is coarsely silicious, and the walls are thick. Just below the rim is a line of nodes made by punching with a round implement from within, and there are indistinct traces of roulette-markings. These pieces have a close analogy with the roulette-stamped ware of Naples, Illinois, and therefore with the whole rouletted group.

It is an interesting fact that much of the pottery from this mound group of the cooking pot class is very nearly duplicated in material, form, and decoration by the archaic Algonquian pottery from the graves and shell heaps of New England.² The more or less curved chisel-like implement with plain or notched edge was used in the same peculiar manner in making the characteristic decorations of both regions, and many of the other forms of ornament are similar. This resemblance may possibly be more than casual. In this connection it may be of interest to note that the "monitor" pipe of the type illustrated in figure 11, c, is also not uncommon in the older graves in New England.

¹ Holmes, *ibid.*, pp. 194, 201.

² C. C. Willoughby, *Pottery of the New England Indians*, Putnam Anniversary Volume, pp. 83-101.



Potsherds from the Turner Group showing typical decorations.

CONCLUSION

General Summary. The people who constructed the Turner Group of Earthworks belonged to that great culture group whose center was in southwestern Ohio, and whose remains are found as far north as Grand Rapids, Michigan, as far west as Naples, Illinois, and as far south as Franklin in central Tennessee. In the height of their power they undoubtedly dominated a considerable portion of this region, and their influence probably extended beyond these limits.

The center of population was apparently the valleys of the three principal rivers of southwestern Ohio: the Great and Little Miami, the Scioto, and their tributaries.

The earthworks which mark the sites of their former occupancy are sometimes very extensive. The embankments form various figures, including squares, parallelograms, circles, and covered ways, which are usually accompanied by tumuli and other mounds. The relation between these remains and the great hill-top fortifications, of which Fort Ancient is perhaps the best example, has not been definitely worked out. It is very improbable that the group of artifacts belonging to what is commonly known as the "Fort Ancient Culture" was connected in any way with the builders of that stupendous earthwork. This culture is the same as that of the great site near Madisonville, which is proto-historic.

The occupancy of southern Ohio by the Great Earthwork Builders must have covered a considerable period of time. This would account for the few local differences in their cultural development.

Their occupation of this region preceded that of another group of Indians of a lower grade of culture, whose remains are found over a large part of southern Ohio, and whose largest village and cemetery, so far as known, were near Madisonville. The last remnants of this later group, who may have been the Monsopelea¹ were apparently in southern Ohio when first heard of by

¹ Dr. John Swanton, in a letter to the writer, calls attention to a tribe "which may possibly be that formerly in occupancy of the Madisonville site, since its history fits in rather well with what may be inferred from the Madisonville remains. This is the Monsopelea, which, when first heard of by the French, was in southern Ohio, but soon moved down to the Mississippi, and ultimately united, in part at least, with the Taensa Indians. In Hanna's Wilderness Trail most that we know about them has been brought together (Vol. II, pp. 97-108). A note on one of the early maps tells us that when they reached the Mississippi they had already obtained

the French. They in turn were succeeded by the Miami, and later by the Shawnee.

The Turner Group of Earthworks is only four miles distant from the Madisonville site.¹ The differences in culture, however, are very marked. The pottery of the Madisonville people belongs to Holmes's central Mississippi group. Nearly all of the cooking pots were supplied with ears for suspension. The Turner Group pottery is without ears, was not made for suspension, and belongs to a group developed apparently from an early form closely resembling the archaic Algonquian type of the northern Atlantic Coast Indians. Hundreds of finely chipped arrowpoints were found at Madisonville; none was recovered during the work at the Turner Group. "Snub-nose" scrapers were abundant at Madisonville; none was obtained at the Turner Group. These are only minor differences, of course, but they show that the cultures of these two people were very unlike, even when applied to many objects in nearly universal use.

Dr. Hooton's study of the skeletal remains shows that physically this people may be classed with certain Algonquian tribes. They were prevailing long headed and differed materially from the people of Madisonville. From the figurines we learn that the common dress of the men seems to have been the breech-cloth, worn without hanging ends. It was probably of dressed skin, colored red. They sometimes wore moccasins of the Algonquian type, fitted with short leggings. The hair of the older men was collected in a knot above the forehead. The warriors shaved the sides of their head, the remaining hair being cut somewhat short, and worn in a ridge extending from the forehead backward across the crown, after the manner of the Sauk and Fox, and other tribes. The women wore the blanket skirt, wrapped around the hips and secured by tucking in one corner at the waist. The hair of the matrons was parted, and gathered into a chignon at the back of the head. They wore what appears to be low shoes of the same form as the woven grass shoes from the Kentucky caves.

firearms. Hanna places them a little east of Madisonville, but they are assigned eight villages on the Franquelin map, so that one of them may have been farther west. Their name appears to be Algonquian, but they united with a people of the Natchez connection. As yet, we must admit that we do not know to what group they really belonged."

¹ For a description of these remains, see *Indian Village Site and Cemetery near Madisonville, Ohio*, by E. A. Hooton, with notes on the artifacts by C. C. Willoughby, Peabody Museum Papers, Vol. VIII, No. 1.

Practically nothing was learned about their habitations. It is doubtful if they were very substantial. There is a possibility that the embankment of the great enclosure may have marked the site of earth-covered dwellings. That structures of some kind, perhaps of a religious or semi-sacred character, formerly occupied many of the mound sites is evident from the presence of numerous post-holes. It is probable that some of these structures, perhaps the ones which occupied the sites of mounds 3 and 4, served as store houses for tribute and other property of chiefs, which was sacrificed upon the altars at their death, the buildings destroyed, and mounds erected over the remains.

Smith, writing of the Virginia Indians, tells us that in a thicket of wood near Orapaks, Powhatan had a treasure house, fifty to sixty yards in length, frequented only by priests, where he kept his treasure, such as skins, beads, pearls, and copper, stored up against the time of his death and burial. Here also was his store of red paint for ornament, bows and arrows, shields, and clubs. At the corners of the house stood four images as sentinels, one a dragon, another a bear, the third like a leopard, and the fourth like a giant-like man, made "evill favouredly according to their best workmanship."¹

If these Indians possessed a stronghold, it must have been either the site of the elevated circle, or the two smaller circles within the great enclosure. Each of the embankments of the latter was bordered by a trench upon its inner side, the usual accompaniment of embankments supporting palisades. It is possible that a council house of a semi-public nature may have stood within the elevated circle, although no direct evidence of this was found.

This people reached a high degree of excellence in their art designs. In this line they were probably unsurpassed by any tribe north of Mexico. In modeling, relief carving, and copper working they also attained high proficiency. As traders they were enterprising and resourceful. They procured obsidian, probably from the Yellowstone; shells from the Florida coast; copper from the Lake Superior region; and mica from the Appalachian Highland. While no ivory artifacts were found during the exploration of this group, several fine carvings of this material were taken from

¹ Captain John Smith, *True Travels*, Richmond Edition, 1819, p. 143.

one of the altars of the Hopewell mounds, and the writer has examined a beautifully made ivory ring from a mound in Indiana. These were probably made of fossil tusks of the mammoth, which may not have been brought a great distance.

So far as the religious beliefs of the people are concerned, but little was learned. That the horned serpent was one of their principal deities is indicated by the mica effigy from the altar of mound 4, and by the finding of parts of what seems to be a larger representation of this god upon the central altar of mound 3. The great Serpent Mound of Adams County, situated between the Scioto and Miami Rivers, about fifty miles to the east of the Turner Group, was probably one of their chief shrines.

Like so many important works of this interesting prehistoric people, the Turner Group of mounds has practically disappeared under the destroying hand of the white man. The elevated circle and a part of the graded way remain, but most of the area which includes the great enclosure is now an immense gravel pit. During a recent visit by the writer, steam shovels were rapidly eating westward to the foot of the graded way. Embankments, mounds, graves, and many feet of gravel beneath them, have gone to form new road beds, another and a more prosaic type of earthwork.

THE SKELETAL REMAINS

BY EARNEST A. HOOTON

The Collection in General. The skeletal remains from the Turner Group of Earthworks now forming a part of the collections of the Peabody Museum represent at least 90 individuals. Eight of these have been cremated; 17 are the remains of immature persons; and 30 are represented by such scanty fragments that they are practically useless for purposes of study. The remaining 35 skeletons are all in a fragmentary condition. Measurements of a few long bones of some, and incomplete measurements and observations on the crania of others were taken wherever possible. Of the skeletons measured or observed, 12 came from intrusive or secondary burials, and it is therefore necessary to consider them separately. This leaves a very inadequate series upon which to base conclusions. One can place little confidence in the chance that such a small sample is representative. Under the circumstances, statistical treatment of measurements would be misleading. The arithmetic mean, for example, of such a short series is often a fictitious figure representing not a single observed frequency. If, however, a high degree of homogeneity characterizes an inadequate series, there is some hope of its being representative.

Measurements and observations upon the material presented here have all been taken by the writer, except the cranial capacities. The latter were measured by Miss Ruth O. Sawtell, according to Hrdlička's method. The writer is also indebted to Miss Sawtell for the recording of the data. Measurements conform to the International Agreement of Monaco, unless otherwise stated. Observations are based upon the system devised by Dr. Ales Hrdlička.

Some time before 1886, Miss C. A. Studley, then Assistant in the Museum, prepared a report upon the crania from the intrusive pit in mound 3. This paper consists of a careful account of the pathological features of the skulls and a minute description of the perforations found in six of the crania, together with measure-

ments and observations on the specimens. It includes measurements on one cranium, number 32413, which I have been unable to find. It also includes many measurements which I have been unable to take on the crania on account of their present fragmentary condition. Some of Miss Studley's measurements agree exactly with mine, but others differ to the extent of several millimeters. This may be due partially to the fact that many of these crania have been mended, presumably by Miss Studley, and have come to pieces, necessitating re-mending. Many of

AGE AND SEX DISTRIBUTION

Infants	Less than 1 year	2-3 years	4-5 years	Total
Number	1	2	2	5
Children	6-8 years	9-10 years	11-12 years	
Number	4	1	0	5
Adolescents	13-14 years	15-16 years	17-18 years	
Number	0	2	3	5
Sub-adults	19-20 years			
Number: male	2			2
" female	1			1
Adults	Young	Middle-aged	Old	
	21-35 years	36-50 years	51- years	
Number: male	1	27	13	41
" female	1	9	4	14
Adults (age doubtful)				
Number: male				6
" female				4
" sex doubtful				7
Total				90

them are somewhat warped, so that re-mending may have changed the dimensions; but aside from this there are certain divergences in results that cannot be reconciled except on the assumption of a difference in methods or in precision of instruments. I have therefore refrained from utilizing Miss Studley's measurements. I also find myself disagreeing with her in respect to the sex of one cranium, number 32411, which I judge to be that of a sub-adult female. I have not included this specimen in most of the tabulations.

In most of the tables given below, percentage distributions of the various characters have been omitted, because such tabulated

percentages are likely to be misleading when they are based upon so small a number of crania. In some instances where there is little sex difference manifested and where the distribution in the two series of male crania is approximately the same, percentage frequencies for the combined series have been given.

The collection includes the remains of 15 children and adolescents and of 75 sub-adults and adults. Of the latter, 49 are males, 19 females, and 7 of indeterminate sex. The excess of males may be due in part to erroneous sexing caused by the fact that many skeletons are represented by a few fragments only, but this cause is not sufficient to account for the disproportions of the sexes.

The sex characters are, for the most part, well marked and little difficulty was encountered in determining the sex of fairly well-preserved skeletons.

Cranial Deformation. A considerable amount of post-mortem deformation and warping has occurred in many of the crania of these series. In many instances this renders them useless for purposes of measurement.

On the other hand, there is very little artificial cranial deformation. In the primary series, 5 of 21 crania show a slight or very slight occipital deformation, in no case sufficiently marked seriously to affect the measurements. In the secondary or intrusive series of 13 crania, one specimen shows a medium degree of occipital deformation and 3 display very slight occipital flattening. But in some cases this inconsiderable flattening is so combined with post-mortem warping as to necessitate throwing out the measurements.

In respect to artificial deformation these series are markedly in contrast with the group of crania from the neighboring Madisonville site previously studied by the writer. Of 53 male crania from the Madisonville site, 73.5 per cent showed occipital deformation, although the flattening was medium or pronounced in only 9.4 per cent of the male series. In the case of females from Madisonville, 29 in number, 82.7 per cent displayed occipital deformation which was medium or pronounced in 13.8 per cent.¹

¹ Hooton, E. A. and Willoughby, C. C., *Indian Village Site and Cemetery near Madisonville, Ohio*, Papers of the Peabody Museum of American Ethnology and Archaeology, Harvard University, Vol. VIII, No. 1, p. 85.

Cranial Vault — Measurements and Indices.

	CRANIAL INDEX				Min.	Mean	Max.
	Dolicho.	Meso.	Brachy.	Total			
Primary series:							
Males: number.....	7	3	2	12	71	75.58	83
Females: ".....	1	4	2	7	70	77.85	83
Secondary series:							
Males: number.....	5	5	0	10	68	74.3	79
Females: ".....	1	0	0	1	..	73.26	..

In the tabulation of cranial indices above, one male skull of the secondary series has been excluded because of a medium occipital deformation (index 83.5), and several others because of post-mortem warping. It includes several indices which may be only approximately correct on account of defective conditions of the specimens. Taken at its face value the table would seem to indicate that the primary series contains a brachycephalic element which is absent from the secondary series.

These skulls, with respect to the cranial index, contrast sharply with the neighboring Madisonville group which included only 2 dolichocephalic crania of a total of 81 measured by the writer, whereas 62 crania or 76.54 per cent were brachycephalic. The Turner group of crania resembles rather the Eastern Indians in its predominant dolichocephaly. Hrdlička found brachycephaly present among the Eastern tribes to the extent of 10.9 per cent in 138 male crania and 10.3 per cent in 145 female crania.¹

The brachycephalic element is slightly more pronounced in our primary series from the Turner Group, if indeed such a short series is at all representative. In the secondary series there is but one brachycephalic cranium, which is the only one of either series presenting a medium occipital deformation. This cranium is almost certainly a naturally mesocephalic specimen.

DIAMETERS OF THE CRANIAL VAULT

	Length				Breadth				Height			
	Glabello-occipital				Maximum				Basion-bregma			
	No.	Min.	Mean	Max.	No.	Min.	Mean	Max.	No.	Min.	Mean	Max.
		mm.	mm.	mm.		mm.	mm.	mm.		mm.	mm.	mm.
Primary series:												
Males	13	175	183.15	191	12	129	138.50	153	3	136	142.66	151
Females	7	169	175.43	186	7	131	136.57	144	3	134	137.33	142
Secondary series:												
Males	10	173	183.80	199	10	124	135.30	145	0	0	0	0

¹ Hrdlička, Alés, *Physical Anthropology of the Lenape or Delawares and of the Eastern Indians in General*, Bureau of American Ethnology, Bulletin 62, p. 113.

The mean length of crania of males in the two series from the Turner Group is approximately the same (183.15 mm. in the primary series and 183.8 mm. in the secondary series), but the primary series with a mean breadth of 138.5 mm. exceeds the secondary series (mean breadth 135.3 mm.).

The Madisonville series of 52 male crania yielded an average glabello-occipital length of 177.4 mm., and that of 29 female crania, 169 mm. The mean breadths of this series were 146.1 mm. and 147.1 mm., respectively. The basion-bregma height in the Madisonville series averages 136.9 for males and 131.3 for females. It is quite apparent that both series from the Turner Group differ from the Madisonville crania in all three skull diameters. The crania from the Turner Group are longer, narrower, and higher. They resemble rather the crania of the Eastern Indians. Our primary series is similar in cranial dimensions and cranial index to those Eastern groups which contain brachycephalic elements such as the Virginia series measured by Hrdlička.¹ The secondary series shows affinities with the more dolichocephalic Eastern tribes, but the writer wishes to avoid overemphasizing these resemblances and differences in view of the small number of crania under consideration.

Height Indices. All but 9 of the Turner Group crania are so defective that the height-length index cannot be ascertained. Three of four male crania in the primary series are hypsiccephalic and one orthocephalic. Three females of the primary series are all hypsiccephals, as is the one male skull of the secondary series in regard to which this index is valid. The mean of the four male crania is 77.72 and of the three female crania 79.66. Miss Studley calculated the mean height-length index of 9 crania of the intrusive or secondary series at 78.9, but her measurements of the basi-bregmatic height must have been mere guesses, unless the crania in question have been broken since she studied them, which is not probable. If any significance is to be attributed to these few height-length indices, it is that they are rather above the average for Eastern Indians, except the Virginia Indians, the crania of which average in two small series of males 76.2 and 79 respectively.² Height breadth indices are too few to merit consideration.

¹ Op. cit., pp. 118-119.

² Hrdlička, op. cit., loc. cit.

Cranial Arcs and Circumferences.

	MEAN VALUES AND RANGE					
	Mean Male mm.	Mean Female mm.	Range Male mm.	Range Female mm.	Number Male	Number Female
Horizontal Circumference:						
Primary series	516	498	495-536	478-512	12	8
Secondary series	515	..	496-537	....	10	..
Nasion-opisthion arc:						
Primary series	381	358	371-400	345-370	6	4
Secondary series	364	..	323-405	....	7	..
Transverse arc:						
Primary series	318	303	305-327	292-320	8	7
Secondary series	309	..	282-328	....	9	..

From an inspection of the table above it may be observed that the mean values of the horizontal circumferences (above brow-ridges) in our primary and secondary series of males from the Turner Group are approximately the same, 516 mm. and 515 mm. respectively. These figures are slightly in excess of the mean for Madisonville males, which is 513 mm.

The figures for the nasion-opisthion arc are based upon very few observations and the mean of the primary series of males (381 mm.) is extremely high as compared with that of the secondary series (364 mm.). The mean of the females of the primary series is also high (358 mm.). The means of corresponding measurements on Madisonville males and females are 361 mm. and 345 mm., respectively. The high mean for this measurement in the case of the males of our primary series is probably due to the circumstance that the only skulls of the short series upon which this measurement could be taken happened to be the largest skulls of the series. The nasion-opisthion arc in 7 Munsee (Delaware) males averaged 371 mm. and in 9 Munsee females 346 mm., according to the work of Dr. Hrdlička.¹

The transverse arc of the males of the primary series averages 318 mm., and of the males of the secondary series 309 mm. This difference may possibly be significant. The figures for Madisonville males and females are 316 mm. and 306 mm., respectively.

Cranial Capacity. Only 2 skulls of the collection are sufficiently well preserved to permit the cranial capacities to be measured.

¹ Op. cit., p. 22.



Dolichocephalic cranium of male, Grave 10, Burial Place a; Primary series, A731.

These are 2 male crania of the primary series, and the capacities (approximate only) are 1420 cc. and 1580 cc. respectively. Miss Studley in her study of the crania of the secondary series records the capacities of 10 skulls. The average was 1485 cc., and the range 1225-1600 cc. The present writer is skeptical in regard to the accuracy of these figures, because many of the crania for which capacities are given are mere fragments.

Thickness of Left Parietal Above Temporo-parietal Suture.

MEAN THICKNESS AND RANGE

	Mean mm.	Range mm.	Number
Primary series: males.....	5	3.3-7.5	12
“ “ females.....	4.8	3.6-6.3	8
Secondary series: males.....	4.5	3.0-5.3	10

This measurement is the average thickness of the left parietal 1 cm. above the squamous suture. The average thickness of the crania of the primary series, 5 mm. in males and 4.8 mm. in females, is moderate for Indians. The mean for males of the secondary series, 4.5 mm., is small.

Minimum Frontal Diameter.

MEAN BREADTH AND RANGE

	Mean		Range		Number	
	Males mm.	Females mm.	Males mm.	Females mm.	Males	Females
Turner Group						
Primary series . . .	92.15	90.50	84-100	85-95	13	10
Secondary series .	93.50	...	89-100	...	10	..
Madisonville series . . .	94.97	92.71	89-103	85-103	48	28

A noticeable feature of the Turner Group series of crania is the narrow, low, but not especially retreating frontal region. The frontal region is often narrow in dolichocephali, but such a low average minimum frontal diameter as is to be observed from the table given above in the case of the males of our primary series is unusual in Indians. For parallel cases we may look once more to the Eastern Indians, among whom Dr. Hrdlička records a mean minimum frontal diameter for 4 Connecticut male crania of 91 mm., and one of 92 mm. for 2 male crania from Staten Island.

Facial, Nasal, and Orbital Measurements and Indices. The facial portions of almost all of the crania from the Turner Group are either entirely missing or fragmentary, so that very few of them can be measured.

Only two of the male crania of our primary series are available for the calculating of the total facial index. These are both leptoprosopic, with indices of 91.24 and approximately 90.8. Of the four male crania from the secondary series upon which this index was obtained, one is euryprosopic with an index of approximately 84.7, one mesoprosopic with an index of 89.26, and two leptoprosopic with indices of 98.56 and approximately 95.31. Three female crania of the primary series are all mesoprosopic with indices of 87.50, 87.69, and 88.37. There were no leptoprosopic crania in the Madisonville series, and over 72 per cent were euryprosopic.

In regard to the upper facial index, two male crania of the primary series are leptene with indices of 55.73 and 58.39. Three of the male crania from the secondary series are mesene, and two leptene. One female cranium of the primary series is mesene and two are leptene. Only about 7.5 per cent of the Madisonville crania are leptene, and in respect to this index the Turner Group series shows a closer similarity to the crania of the Tennessee stone graves, among which Fuller found 34 per cent leptene. Several groups of Eastern Indians measured by Hrdlička show average leptene indices. The facial skeletons of both of our series are relatively long and narrow.

Of 5 nasal indices calculated on male crania of the primary series, 1 is platyrrhine, 2 are mesorrhine, and 2 leptorrhine; 6 nasal indices on males of the secondary series are all leptorrhine; of 4 nasal indices of females of the primary series 2 are mesorrhine and 2 leptorrhine.

The mean orbital indices of 3 male crania from the primary series are all hypsiconch (89 and over); in the intrusive series of males the distribution of 4 orbital indices is as follows: 1 chamaeconch (under 83), 2 mesoconch, and 1 hypsiconch. Three female crania of the primary series are mesoconch, and 2 are hypsiconch.

External Palatal Index (Maxillo-alveolar). One male cranium of the primary series is dolichuranic (below 110), 1 is mesuranic, and 2 are brachyuranic (above 115). These 4 indices yield a mean of 118.7. Of the males of the secondary series 1 is mesuranic and 4 are brachyuranic, yielding together a mean index of 117.6. The females of the primary series show 3 mesuranic indices and 3 brachyuranic indices, with a mean of 116.7.

Alveolar Index (Gnathic Index). This index is obtainable on 6 crania of the combined series. All are orthognathous, except one male of the primary series which is mesognathous.

Lower Jaw.

MEAN DIMENSIONS

	Males		Males		Females	
	Primary series Number	Mean mm.	Secondary series Number	Mean mm.	Primary series Number	Mean mm.
Bigonial diameter.....	4	101	8	105.8	4	96.7
Mean angle.....	7	120.1	8	123.3	5	124.4
Height of symphysis.....	7	37.6	8	37	8	34.9
Width bicondylar.....	1	131	6	125.8	5	117.4
Minimum breadth of ascending ramus.....	11	36.4	10	34.7	7	34.5
Height of ascending ramus	9	63	10	62.4	8	57.2
Condyllo-symphyseal length	4	108.5	9	108.9	5	99.8

The mandibles of these series are longer than those of the Madisonville series, and judging from the males of the secondary series, are narrower. The mean condyllo-symphyseal length for Madisonville males (24) is 104.6, but for 7 females 104.5. The bicondylar width of 22 Madisonville male crania averages 129 mm. and of 7 females, 122.7 mm.

Frontal Region.

OBSERVATIONS

	Primary series		Secondary series	
	No. of males	No. of females	No. of males	Total
Height low:				
Breadth submedium, Slope submedium	0	2	2	4
Breadth submedium, Slope medium ...	3	2	3	8
Breadth submedium, Slope pronounced	1	1	1	3
Breadth medium, Slope submedium ...	1	0	0	1
Breadth medium, Slope medium	2	0	0	2
Breadth medium, Slope pronounced	1	0	2	3
Breadth pronounced, Slope medium ...	1	0	0	1
Total: number.....	9	5	8	22
per cent.....	69.2	50	72.7	64.7
Height medium:				
Breadth submedium, Slope submedium	0	1	0	1
Breadth submedium, Slope medium ...	2	2	1	5
Breadth medium, Slope submedium ...	2	1	0	3
Breadth medium, Slope medium	0	1	2	3
Total: number.....	4	5	3	12
per cent.....	30.7	50	27.2	35.2

Observations on the frontal region refer to the combinations of height, breadth, and slope. Each of these may be adjudged submedium, medium, or pronounced. There are thus 27 possible combinations of the three observed characters, of which 11 occur in the two series from the Turner Group. There are no crania which are classified as high; about 70 per cent of both male series and 50 per cent of the female series are low. The following tabulation shows the distribution of breadth and slope considered independently.

BREADTH AND SLOPE OF FRONTAL REGION

	Breadth			Slope		
	Submedium	Medium	Wide	Submedium	Medium	Pronounced
Primary series:						
Males: number . . .	6	6	1	3	8	2
Females: number . .	8	2	0	4	5	1
Secondary series:						
Males: number . . .	7	4	0	2	6	3
<hr/>						
Total: number . .	21	12	1	9	19	6
per cent	61.7	35.2	2.9	26.4	55.8	17.6

From the tables above it may be seen that the prevailing type of frontal region in the males and females of both series is low, narrow, and of medium slope. The females show a larger number of cases in which the slope is submedium or steep. The low and narrow, but only moderately sloping frontal region, is a marked characteristic of most of the crania from this site. It is strikingly represented in the conformation of the forehead of certain clay figurines from the site, described by Mr. Willoughby (p. 71).

Sagittal Region.

OBSERVATIONS

	Primary series		Secondary series	
	Males	Females	Males	Total
Breadth submedium:				
Elevation absent	1	0	1	2
Elevation submedium	1	1	1	3
Elevation medium	1	1	1	3
Elevation pronounced	0	0	0	0
<hr/>				
Total: number	3	2	3	8
per cent	23.1	22.2	27.2	24.2



Mesocephalic cranium, Grave 18, Burial Place a; Primary series, A748.

	Primary series		Secondary series	
	Males	Females	Males	Total
Breadth medium:				
Elevation absent.....	0	2	4	6
Elevation submedium.....	4	3	3	10
Elevation medium.....	2	0	1	3
Elevation pronounced.....	1	1	0	2
	<hr/>	<hr/>	<hr/>	<hr/>
Total: number.....	7	6	8	21
per cent.....	53.8	66.6	72.7	63.6
Breadth wide:				
Elevation absent.....	1	0	0	1
Elevation submedium.....	0	0	0	0
Elevation medium.....	2	1	0	3
Elevation pronounced.....	0	0	0	0
	<hr/>	<hr/>	<hr/>	<hr/>
Total: number.....	3	1	0	4
per cent.....	23.1	11.1	0	12.1

A perusal of the table above shows that the crania of our primary series are prevailingly of medium breadth with a submedium sagittal elevation, and that the same holds true of the males of our secondary series except that the sagittal elevation is more frequently absent. Separate tabulations of the development of the sagittal elevation and of the postcoronoid depression follow.

	SAGITTAL ELEVATION				POSTCORONOID DEPRESSION			
	Absent	Sub-medium	Medium	Pro-nounced	Absent	Sub-medium	Medium	Pro-nounced
Primary series:								
Males.....	2	5	5	1	3	8	2	0
Females.....	2	4	2	1	2	7	0	0
Secondary series:								
Males.....	5	4	2	0	4	6	0	1
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Total: number	9	13	9	2	9	21	2	1
per cent	27.2	39.3	27.2	6.1	27.2	63.6	6.1	3

The sagittal elevation is more strongly developed in the males of the primary series than in the females, and more strongly developed in both sexes of the primary series than in the males of the secondary series. The same is true of the postcoronoid depression. The sagittal elevation is not so well developed in these

series as in the Madisonville crania, but the postcoronoid depression is much more common.

Temporal Region.

	OBSERVATIONS			
	Flat or Compressed	Medium	Protuberant	Total
Primary series:				
Males	9	2	2	13
Females	2	4	2	8
Secondary series:				
Males	9	1	1	11
Total: number	20	7	5	32
per cent	62.5	21.8	15.6	

The temporal region in the males of both series is predominantly flat or compressed as is to be expected in long heads. The females show a greater convexity of this region. In the Madisonville series almost equal proportions of the three categories appear in both sexes.

Occipital Region.

	OBSERVATIONS			Total
	Primary series Males	Primary series Females	Secondary series Males	
Flat or steep:				
Torus absent	2	2	1	5
Torus submedium	1	0	1	2
Torus medium	1	0	1	2
Total: number	4	2	3	9
per cent	33	28.5	37.5	33.3
Medium convex:				
Torus absent	6	5	3	14
Torus submedium	0	0	1	1
Torus medium	1	0	0	1
Torus pronounced	0	0	1	1
Total: number	7	5	5	17
per cent	58.3	71.4	63.5	62.9
Protuberant:				
Torus medium	1	0	0	1
Total: per cent	8.3	0	0	3.7

An inspection of the table above shows that the occipital region is predominantly medium convex, and with no development of the occipital torus. This table excludes 1 female cranium, flat and deformed with a slight torus, and 3 flat deformed male crania of the secondary series, 2 of which have a slight torus. The complete tabulation of the occurrence of the occipital torus is as follows:

OCCIPITAL TORUS

	Absent	Submedium	Medium	Pronounced	Total
Primary series:					
Males.....	8	1	3	0	12
Females.....	7	1	0	0	8
Secondary series:					
Males.....	5	4	1	1	11
Total: number.....	20	6	4	1	31
per cent.....	64.5	19.3	12.9	3.2	

The occipital torus occurs more frequently in the males of the secondary series than in the males of the primary series, and is almost absent from the female crania.

Sutures.

OCCLUSION OF CORONAL, SAGITTAL, AND LAMBDOID SUTURES

	All open	All beginning	Almost obliterated	Miscellaneous	Total
Primary series:					
Males.....	4	1	2	6	13
Females.....	6	1	1	1	9
Secondary series:					
Males.....	3	0	2	6	11
Total.....	13	2	5	13	33

From the table above it may be seen that a larger proportion of female crania show no exterior signs of sutural occlusion than is the case with either of the male series.

Five of the 6 crania in the primary series of males classified as miscellaneous, show obliteration more advanced in the coronal suture than in the sagittal and lambdoid sutures. The order of obliteration is probably C-S-L in this series of males. Three of

the miscellaneous crania of the secondary series show obliteration farther advanced in the sagittal than in the coronal or lambdoid; in two others there is equal obliteration in the coronal and sagittal and less in the lambdoid; and in the sixth, obliteration has proceeded farthest in the lambdoid.

	SERRATION			Total
	Simple	Medium	Complex	
Primary series:				
Males.....	2	11	0	13
Females.....	4	5	0	9
Secondary series:				
Males.....	7	3	1	11

Serration of sutures in the primary series of males is prevalently medium, which is unusual for Indians. In the secondary series there is the usual predominance of simple sutures.

	WORMIAN BONES					Total
	None	Lambdoid	Temporo-parietal	Temporo-occipital	Others	
Primary series:						
Males.....	4	6	1	0	0	11
Females.....	4	3	0	2	0	9
Secondary series:						
Males.....	1	7	0	0	3	11

The secondary series differs from the primary series in the larger number of crania with Wormian bones in the lambdoid suture. There are also two crania in this series with "Inca" bones, and one with an epipterice suture.

	PTERIONS				Total
	H type narrow	H type medium	H type broad	K type	
Primary series:					
Males.....	2	3	1	1	7
Females.....	1	7	1	0	9
Secondary series:					
Males.....	1	8	0	0	9

The table above shows that the form of the pterion is usually a medium H in all of the groups considered.

Parietal Foramina.

	NUMBER AND SIZE							Total
	None	One small	Two small	One medium	One small	Three small	One large	
Primary series:								
Males.....	6	3	1	1	0	0	1	12
Females.....	4	4	0	0	0	0	0	8
Secondary series:								
Males.....	4	3	1	0	1	1	0	10
Total: number	14	10	2	1	1	1	1	30
per cent	46.6	33.3	6.6	3.3	3.3	3.3	3.3	

Parietal foramina are absent in 50 per cent of the males and females of the primary series, and in 40 per cent of the males of the secondary series. In the Madisonville series parietal foramina are absent in 45 per cent of males and 58 per cent of females.

The number of retromastoid foramina could be recorded in a very few crania only. Usually there are a larger and a smaller on each side, but they are extremely variable in size, number, and position.

Mastoids.

	SIZE			Total
	Small	Medium	Large	
Primary series:				
Males.....	6	6	1	13
Females.....	9	0	0	9
Secondary series:				
Males.....	2	7	2	11

These are small in all females, and in 46.1 per cent of the males of the primary series, but in only 18.1 per cent of the males of the secondary series. The percentage distribution of the males of the primary series is approximately the same as that of the males of the Madisonville series, but the females of the Madisonville series have better developed mastoids than the females of our series from the Turner Group.

Supraorbital Ridges.

SUPRAORBITAL RIDGES — TYPE

	Primary series		Secondary series	Total
	Males	Females	Males	
Median type:				
Submedium.....	2	4	3	9
Medium.....	4	1	1	6
Large.....	0	0	1	1
	—	—	—	—
Total.....	6	5	5	16
Divided type:				
Submedium.....	2	2	2	6
Medium.....	3	0	3	6
Large.....	1	0	1	2
	—	—	—	—
Total.....	6	2	6	14
Torus type:				
Large.....	1	0	0	1
Absent.....	0	3	0	3

SUPRAORBITAL RIDGES — SIZE

	None	Traces	Submedium	Medium	Large	Total
Primary series:						
Males: number.....	0	0	4	7	2	13
per cent.....	0	0	30.7	53.8	15.3	
Females: number...	3	6	0	1	0	10
per cent... 30	60	0	10	0		
Secondary series:						
Males: number.....	0	0	5	4	2	11
per cent.....	0	0	45.4	36.3	18.1	

Supraorbital ridges in the males of the two series are about evenly divided between the median type, in which they are confined to median portions of the orbits, and the divided type in which the lateral portions of the superior orbital margins are thickened to form ridges which are divided from the median ridges by a groove leading upward from the supraorbital notch. The torus type occurs in one cranium only. In the females, the supraorbital ridges are either absent or show very slight development, except in one case.

Facial Region. The facial parts are so defective in the majority of the crania of these series that few observations were recorded. The height, breadth, and slope of the nasal bridge, for example, was

ascertained in only one cranium of our primary male series. This specimen has a high, narrow, and straight bridge. In two other specimens of this series the nasal bridges are medium in height and in breadth, and low and narrow respectively, but the slope of the nasal bones could not be ascertained. In the female series, four observations are as follows: 1 low, medium broad, concave; 1 low, medium broad, straight; 1 medium high, narrow, straight; 1 medium high, narrow, concavo-convex. In the males of the secondary series there occurred the following: 1 low, narrow, concavo-convex; 1 low, medium broad, concavo-convex; 1 medium high, medium broad, concavo-convex. Of four others in this series in which the slope could not be ascertained the combinations of height and breadth are as follows: 1 low, narrow; 2 low, medium broad; 1 medium high, narrow. It is impossible to draw many conclusions from such data. High, narrow, and straight noses occur in the primary series, while low or medium noses of medium breadth and concavo-convex in slope seem to prevail among the males of the secondary series.

Nasion depressions, properly speaking, are practically non-existent in this series. There is usually a depression below nasion, but any depression of the fronto-nasal suture itself is due entirely to the prominence of glabella.

LOWER BORDERS OF NASAL APERTURE AND NASAL SPINE

	Primary series		Secondary series	Total
	Males	Females	Males	
Borders indistinct:				
Spine small	4	3	6	13
Spine medium	1	1	0	2
Spine large	0	0	0	0
	—	—	—	—
Total	5	4	6	15
Borders medium:				
Spine small	0	1	0	1
Spine medium	0	2	2	4
Spine large	1	0	1	2
	—	—	—	—
Total	1	3	3	7

The table above shows that the prevailing form of lower borders of nasal aperture is indistinct, with a small development of the nasal spine in all groups considered. Similar results were

found in the crania from the Madisonville site. Subnasal grooves are absent in all of 6 of the male crania of the primary series, slightly developed in one of 7 crania of the female series, and moderately developed in 2 of 9 male crania of the secondary series. The males of the secondary series appear to have slightly more primitive features of the nasal aperture than those of the primary series.

SHAPE OF ORBITS AND INCLINATION OF LATERAL AXIS

	Primary series		Secondary series	
	Males	Females	Males	Total
Nearly oblong:				
Inclination none.....	0	2	1	3
Inclination slight.....	1	1	1	3
Inclination medium.....	2	1	6	9
Inclination marked.....	0	1	0	1
	—	—	—	—
Total.....	3	5	8	16
Nearly square:				
Inclination none.....	1	0	0	1
Inclination submedium.....	1	1	0	2
Inclination medium.....	1	1	1	3
	—	—	—	—
Total.....	3	2	1	6

Features of interest in the observation of orbits are the shape and inclination of the lateral axis. The usual shapes are approximately oblong with rounded corners, or approximately square with rounded corners. Strictly speaking, when the lateral axis of an orbit is much inclined, the form of the orbit is rhomboidal, rather than square or oblong. Marked inclination of the lateral axis of the orbit is more common in narrow, long-faced crania than in short, broad-faced crania, in which the orbits are likely to be oblong with little inclination. Square forms of the orbit are also more common in long, narrow faces. In the males of the primary series from the Turner Group, 3 crania are of oblong shape and 3 square. Five of 7 female crania, and 8 of 9 crania in the males of the secondary series are oblong. Inclination of the lateral axis is usually slight or medium in these series.

INFRAORBITAL SUTURE

	Absent	Complete one side	Complete both sides	Total
Primary series:				
Males.....	5	1	1	7
Females.....	5	0	2	7
Secondary series:				
Males.....	6	0	1	7
Total: number.....	16	1	4	21
per cent.....	76.2	4.7	19	

SUBORBITAL FOSSAE

	Shallow	Medium	Deep	Total
Primary series:				
Males.....	0	5	0	5
Females.....	5	1	1	7
Secondary series:				
Males.....	4	5	0	9
Total	9	11	1	21

The depth of the suborbital fossae in these series is prevailingly medium or slight. It may be observed from the table above that the males of the primary series are sharply contrasted with the females in respect to the development of this feature. Shallow suborbital fossae are often associated with broad, short faces.

MALARS

	Small	Medium	Large	Very large	Total
Primary series:					
Males.....	0	4	3	0	7
Females.....	2	3	1	0	6
Secondary series:					
Males.....	0	3	5	1	9
Total	2	10	9	1	22

On the basis of the table above the males of the secondary series seem to have somewhat larger malars than those of the primary series. As usual the malars of the females are decidedly smaller than those of the males. There are no anomalies of malar bones in any of these crania.

ZYGOMAE					
	Small	Medium	Large	Very large	Total
Primary series:					
Males.....	1	4	2	0	7
Females.....	2	3	1	0	6
Secondary series:					
Males.....	0	3	5	1	9
Total	3	10	8	1	22

The males of the secondary series have larger zygomae than those of the primary series. The females show the usual sex differences in the smaller size of the zygomae as compared with males. The zygomae of the males of the primary series seem rather small for Indians.

ALVEOLAR PROGNATHISM					
	Absent	Slight	Medium	Pronounced	Total
Primary series:					
Males.....	0	4	0	3	7
Females.....	1	1	4	1	7
Secondary series:					
Males.....	0	6	0	2	8
Total	1	11	4	6	22

The distribution of alveolar prognathism is very irregular.

Teeth.

	DENTITION		WEAR				Total
	Complete	Incomplete	None	Slight	Medium	Pronounced	
Primary series:							
Males.....	10	1	0	2	3	6	11
Females.....	9	0	0	2	4	3	9
Secondary series:							
Males.....	9	1	1	1	4	4	10
Total	28	2	1	5	11	13	30

In both cases the dentitions listed as incomplete in the tables above show imperfectly erupted third molars. On the whole, this series includes a high percentage of crania with deeply worn teeth (43.3 per cent). This is a result, in all probability, of the small number of young adults included in the series. The following table shows the relation of estimated age to dental wear.

WEAR OF TEETH

	None	Slight	Medium	Pro-nounced	Very pronounced	Total
Estimated age:						
Sub-adult (19-20 years) . .	1	..	..	..	..	1
Young adult (21-35 years) . . .		2	..	..	..	2
Middle aged (36-50 years) . . .		3	11	6	..	20
Old adult (51-years) . . . . .		..	..	..	7	7

QUALITY OF TEETH

	Poor	Medium	Good	Total	Caries	Abscesses	Teeth lost in life
Primary series:							
Males	3	3	5	11	3	2	2
Females	1	2	6	9	2	3	2
Secondary series:							
Males	2	1	6	9	1	2	4
Total: number . .	6	6	17	29	6	7	8
per cent . .	20.6	20.6	58.6		20.6	24.1	27.5

The table above shows that the quality of the teeth in these series is generally good. Caries and alveolar abscesses are not especially prevalent.

NUMBER OF CUSPS

	Upper molars			Lower molars		
	4-4-4	4-4-3	4-4-2	5-5-5	5-5-4	5-4-4
Primary series:						
Males	0	3	1	1	3	0
Females	0	2	0	1	0	1
Secondary series:						
Males	0	1	0	4	0	1
Total: number	0	6	1	6	3	2

The number of crania in which the cusps of the molar teeth can be counted is very few. The table above shows a tendency toward reduction of cusps in the third molars. The following abnormalities of eruption are recorded. Primary series: crowding of incisors, 1 male, 1 female; absence of third molars, 1 male; impacted lower left third molar, 1 male; pronounced reduction of lower left first incisor, 1 female. Secondary series: crowding of teeth, 1 male; reduction of third molars, 1 male.

Thirteen crania had shovel-shaped incisors, and one had not. In the remainder of the series the presence or absence of this feature could not be determined.

Palate.

	SHAPE			ROOF			TORUS	
	U-shaped	Parabolic	Elliptical	Low	Medium	High	Present	Absent
Primary series:								
Males.....	3	3	0	0	1	5	1	5
Females.....	2	2	3	1	4	2	4	3
Secondary series:								
Males.....	1	4	0	0	2	3	0	5
Total: number	6	9	3	1	7	10	5	13

Determination of the shape of the palate was possible in a few crania only. The parabolic type seems to be predominant in the males of the secondary series, and the elliptical type seems to be confined to females. The roof is prevailing of medium height in females and high in males. A slight or medium development of the palatine torus is common in the female crania.

Skull Base. In these series the skull base is usually so fragmentary that few observations can be made. In the primary series of females it was ascertained that 5 crania had small styloid processes, and 2 had large styloid processes.

	GLENOID FOSSA — DEPTH				POSTGLENOID PROCESS				
	Shallow	Medium	Deep	Total	Absent	Small	Medium	Large	Total
Primary series:									
Males.....	2 ¹	6	5	13	3	2	7	1	13
Females.....	2	4	3	9	4	1	3	1	9
Secondary series:									
Males.....	3 ²	2	5	10	1	4	4	1	10
Total: number....	7	12	13	32	8	7	14	3	32
per cent ...	21.8	37.5	40.6		25	21.8	43.7	9.3	

The glenoid fossa is usually deep or of medium depth in these series. It is somewhat shallower in the females. There is often a moderate postglenoid process. Apparently this feature occurs more frequently in long heads than in short heads. It is rarer in

¹ Both arthritic.² One arthritic.

females than in males. In the Madisonville series the occurrence was about 30 per cent in males and only 10 per cent in females.

In the few cases where the lacerate foramina were observed, they were small. The depression of the petrous portions of the temporal bones in the combined males and females of the primary series is as follows: 2 slight, 5 medium, 2 pronounced; in the males of the secondary series, 1 absent, 2 medium.

PTERYGO-SPINOUS FORAMINA

	Absent	Incomplete one side	Incomplete both sides	Complete one side	Complete both sides	Total
Primary series:						
Males.....	5	0	1	0	0	6
Females.....	4	0	2	0	0	6
Secondary series:						
Males.....	3	1	0	1	0	5
	—	—	—	—	—	—
Total	12	1	3	1	0	17

Pterygo-spinous foramina are uncommon in these crania.

DEHISCENCES IN THE FLOOR OF THE AUDITORY MEATUS

	None	One small	Two small	One medium	Total
Primary series:					
Males.....	7	1	1	1	10
Females.....	5	0	1	0	6
Secondary series:					
Males.....	8	0	0	0	8
	—	—	—	—	—
Total	20	1	2	1	24

Defects in the floor of the auditory meatus are common in the primary series but absent from the secondary series.

Mandible.

	SIZE				MENTAL PROMINENCE				
	Small	Medium	Large	Total	None	Small	Medium	Large	Total
Primary series:									
Males.....	2	6	4	12	0	3	7	2	12
Females.....	3	4	2	9	1	3	4	1	9
Secondary series:									
Males.....	3	4	3	10	0	4	4	2	10
	—	—	—	—	—	—	—	—	—
Total	8	14	9	31	1	10	15	5	31

MEASUREMENTS OF CRANIA FROM THE

	Catalogue No.	Sex	Age	Deformation	Length	Breadth	Height	Cranial Index	Height-Length Index	Height-Breadth Index	Menton-Nasion Height (a)	Alveon-Nasion Height (b)	Dian. Bizygomatic maxim. (c)	Facial Index, total ($\frac{a \times 100}{c}$)	Facial Index, upper ($\frac{b \times 100}{c}$)	Basion-Alveon (x)
PRIMARY SERIES	A731	♂	old	—	183	136	136	74.32	74.32	100.00	119	72	?	?	?	101
	A560	♂	old	—	179	(120)	?	(67.04)	?	?	?	?	?	?	?	?
	30117	♂	mid.	—	(175)	139	?	(79.43)	?	?	125	80	137	91.24	58.39	?
	A701	♂	mid.	—	178	140	141	78.65	77.90	99.29	119	73	(131)	(90.84)	(55.73)	102
	A628	♂	old	med. pm.	185	(153)	151	(82.70)	81.63	(98.69)	(129)	82	?	?	?	100
	A727	♂	mid.	—	190	140	(147)	73.68	(77.37)	(105.)	?	?	?	?	?	?
	A8	♂	old	—	181	144	?	79.56	?	?	?	?	?	?	?	?
	A835	♂	old	sl. occ.	182	129	?	70.88	?	?	?	?	?	?	?	?
	30116	♂	mid.	med. pm.	188	(133)	?	70.74	?	?	?	?	?	?	?	?
	34366	♂	mid.	sl. r. occ.	191	139	?	72.77	?	?	(138)	(83)	?	?	?	?
	A541	♂	mid.	sl. lamb.	191	141	?	73.82	?	?	?	?	?	?	?	?
	A4	♂	y. ad.	—	177	135	?	76.27	?	?	?	?	?	?	?	?
	A534	♂	mid.	—	181	(133)	?	(73.48)	?	?	?	?	?	?	?	?
	A748	♀	y. ad.	—	179	138	?	77.07	?	?	114	69	129	88.37	53.49	?
	A829	♀	sub. ad.	—	176	139	?	78.98	?	?	?	?	?	?	?	?
	A632	♀	mid.	—	?	?	?	?	?	?	?	?	?	?	?	?
	A627	♀	mid.	pm. pron. sl. occ.	(167)	(147)	?	(88.54)	?	?	114	74	(130)	87.69	(56.92)	?
	A612	♀	mid.	med. pm.	176	144	142	81.82	80.68	101.41	119	75	(136)	87.50	55.15	(88)
	A16	♀	mid.	sl. occ.	169	141	?	83.43	?	?	(115)	70	?	?	?	?
	A726	♀	mid.	—	169	131	134	77.51	79.29	97.76	?	?	?	?	?	?
	58001	♀	old	sl. pm.	186	131	?	70.43	?	?	?	?	?	?	?	?
	30137	♀	mid.	?	?	?	?	?	?	?	?	77	?	?	?	?
	A538	♀	mid.	—	173	132	136	76.30	78.61	97.06	?	?	?	?	?	100
SECONDARY OR INTRUSIVE SERIES	32408	♂	mid.	med. pm.	177	134	?	75.71	?	?	137	83	139	98.56	59.71	?
	32419	♂	mid.	—	185	(136)	?	(73.51)	?	?	?	?	?	?	?	?
	32416	♂	mid.	—	199	135	?	67.84	?	?	133	77	149	89.26	51.68	?
	32417	♂	mid.	—	183	145	?	79.23	?	?	(122)	73	(144)	(84.72)	(50.69)	?
	32415	♂	old	sl. l. occ.	176	137	?	77.84	?	?	?	?	?	?	?	?
	32412	♂	mid.	—	186	140	?	75.27	?	?	?	?	?	?	?	?
	32410	♂	old	med. occ.	(170)	(142)	(152)	(83.53)	(89.41)	(93.42)	?	(76)	139	?	(54.68)	98
	32421	♂	old	med. pm. sl. occ.	(184)	(132)	?	(71.74)	?	?	(122)	71	(128)	(95.31)	(55.47)	?
	32420	♂	mid.	med. pm. sl. occ.	(180)	(136)	?	(75.56)	?	?	?	?	?	?	?	?
	A629	♂	sub. ad.	sl. pm.	(173)	124	137	(71.68)	(79.19)	90.51	?	?	?	?	?	?
	A633	♂	old	—	185	134	?	72.43	?	?	?	?	?	?	?	?
	32411	♀?	sub. ad.	—	172	126	?	73.26	?	?	112	?	(122)	(91.80)	?	?

KEY TO ABBREVIATIONS

sub. ad. = sub-adult (19-20 yrs.).
y. ad. = young adult (21-35 yrs.).
mid. = middle aged adult (36-50 yrs.).

old = old adult (51- yrs.).
sl. = slight.
med. = medium.

[illegible]

KEY TO ABBREVIATIONS

pron. = pronounced

occ. = occipital

pm. = post-mortem

lamb. = lambdoid.

Parentheses indicate that measurement or index is approximate because of defective condition or because of deformation.

	MYLO-HYOID RIDGE				GENIAL TUBERCLES			
	Absent	Sub-medium	Medium	Pronounced	Absent	Small	Medium	Total
Primary series:								
Males.....	0	6	6	0	1	4	7	12
Females.....	1	4	4	0	1	7	1	9
Secondary series:								
Males.....	0	3	6	1	0	6	4	10
Total	1	13	16	1	2	17	12	31

The size distribution of mandibles is ordinary, as is also the development of the mental prominence. Mylo-hyoid ridges and genial tubercles are better developed in this series than in the Madisonville crania.

Miscellaneous and Pathological. Aside from one or two small lesions of traumatic origin on these crania, and three cases of arthritis affecting the glenoid fossae, there is nothing of interest to report in the way of pathological features. Caries and alveolar abscesses have been dealt with above. One skull of the secondary series shows two small exostoses on the frontal bone, and three have slight exostoses in the auditory meatus.

In six crania of the secondary series, nearly circular holes have been drilled, as discussed by Mr. Willoughby above (p. 61). These are primarily of ethnological rather than somatological interest. They were evidently bored with a stone drill. The edges are clean and show no cicatrization. The following are the perforated crania:

No. 32410. One hole, 6 mm. in diameter in the left parietal, 46 mm. back of the coronal suture, and 30 mm. external to the sagittal suture.

No. 32411. Two nearly round holes, 6 and 9 mm. in diameter, one in the frontal bone 3 mm. in front of bregma and a little to the left of it, the other in the right parietal 5 mm. back of the coronal suture and a little to the right of bregma.

No. 32412. Two holes, each 6 mm. in diameter, one near the middle of the right parietal, the other in approximately the same position in the left parietal.

No. 32413. Two holes in the frontal bone 5 mm. in diameter and 35 mm. apart, one in each parietal 8 mm. above the squamous suture and 30 mm. back of the coronal suture.

No. 32414. One hole in each parietal bone, symmetrically placed.

No. 32415. Eleven perforating holes and one unfinished hole, ranging in diameter from 3-6 mm. Six of these holes are disposed in pairs, 5-8 mm. between each member of a pair (plate 27).



Crania with perforations (32415, upper; and 32411) from the intrusive pit of Mound 3.

Scaling of the inner table of the skull vault at the points of perforation suggests that the holes were made when the skulls were comparatively dry. All of the crania from this intrusive pit are green and fresh in comparison with the dry, chalky bones of the primary series.

Bones in General. The skeletal parts other than the crania are few in number and fragmentary in condition.

Femur.

MEASUREMENTS									
Bicondylar length Paired bones			Maximum length Paired bones			Maximum diameter of head			
No.	Right mm.	Left mm.	No.	Right mm.	Left mm.	No.	Right mm.	Left mm.	
Primary series:									
Males: mean	8	437.2	438.7	8	440	442.2	14	46	45.5
Females: mean	6	431.3	430.3	6	435.3	434	8	41.5	42.2

The number of paired femora is unfortunately small. If odd bones are taken into consideration, the mean bicondylar length of 10 right femora of males is 441.7 mm. and of 7 left femora, 443.4 mm. The maximum length of 7 left femora of males averages 448.8. If we utilize the mean bicondylar length of the 10 right femora, the average stature for 10 males according to Manouvrier's tables is 165.8 cm. and according to Pearson's formula for oblique length ¹ 164.8 cm.

The mean bicondylar lengths for paired Madisonville femora are slightly larger (444 mm. right, 447 mm. left), as are also the maximum lengths, (449 mm. right, 451 mm. left). The average stature of Madisonville males is estimated to be 166-167 cm.

The mean bicondylar length of 5 right femora of females is 430.8 mm., which would correspond to a stature of somewhat more than 158 cm. according to Manouvrier, and to a stature of 157 cm. according to Pearson. The mean bicondylar lengths for Madisonville females are 410 mm. and 419 mm., respectively for right and left sides. The estimated stature of Madisonville females is 155 cm.

The femoral lengths of females are rather high in comparison with the males. This is partially because of the inclusion in the very small male series of one exceptionally short individual whose bicondylar femoral lengths were only 513 mm. and 515 mm.

¹ Pearson, K. and Bell, J., *A Study of the Long Bones of the English Skeleton*, Drapers' Company Research Memoirs, Biometric Series X, London, 1919, p. 5.

The femora of the secondary series of males include 2 paired and 2 odd only. The bicondylar lengths of three left femora are 451 mm., 468 mm., and 481 mm. The corresponding maximum lengths are 455 mm., 475 mm., 489 mm. The mean bicondylar lengths of these three bones is 466.6 mm. and of maximum lengths 473 mm. These three individuals must have been about 167, 170, and 172 cm. in stature. The largest male in the primary series had a left femur with bicondylar and maximum lengths of 461 mm. and 467 mm., respectively. He probably had a stature of about 168.5 cm. It is scarcely safe to attach much importance to the results of so few measurements in a bone individually so variable as the femur, but on the face of the evidence, such as it is, our secondary series of males must have been somewhat taller than the males of the primary series.

The difference between the statures of males and females (7.8 cm.) as estimated from Pearson's formula is comparatively small. The females are estimated at 157 cm. in stature and the males at 164.8 cm. The sex ratio is unreasonably low (1.049). The maximum diameters of the femoral heads average for rights, 46 mm. in males and 41.5 mm. in females; and for lefts, 45.5 mm. and 42.2 mm. For Madisonville femora the head diameters are as follows: right, males 47.2, females 43.6; left, males 46.7, females 42.3. The sex differences in this feature are more pronounced in the Turner series than in the Madisonville series. According to Pearson¹ the mean percentage reduction of the diameter of the male femoral head necessary to obtain that of the female femoral head in the English femur is about 12.7. In our series the difference on the right side is 10.2 per cent and on the left side only 7.2 per cent. In the males the right femora are longer and have larger heads, but in the females the reverse is the case. On the whole the writer is inclined to believe that the male series of femora is not a representative sample in that it includes too many small bones. If this hypothesis is rejected we are reduced to two alternatives: (a) that sexual differences in the size of the femora are unusually small in this series, or (b) that the present writer has made serious errors in sexing the material. The writer has had a good deal of experience in anatomical sexing of skeletal material and has a fair degree of confidence in his own accuracy.

¹ Op. cit., p. 145.

MEAN SHAFT DIAMETERS AND INDICES (PAIRED BONES)

		Subtrochanteric region				Middle of shaft		
	Number	Diameter minimum (a) mm.	Diameter maximum (b) mm.	Platymetric index $\frac{(a) \times 100}{(b)}$	Number	Diameter sagittal (c) mm.	Diameter lateral (d) mm.	Middle index $\frac{(d) \times 100}{(c)}$
Primary series:								
Males: right	8	25.2	31.5	80.5	9	30.4	24.9	81.8
“ left	8	25.3	31.4	80.5	9	30.6	25.2	82.3
Females: right	5	23.3	30.5	76.2	6	27.4	24.3	89
“ left	5	24	31.2	76.8	6	27.7	24.5	89.8

The table above shows that the males of the primary series are but slightly platymetric, and the females somewhat more so. On the other hand, the middle index shows a pronounced development of the pilaster in the males, and a less developed pilaster in the females. Madisonville femora are much more platymetric in both sexes (right, males 77.1, females 72.6; left, males 76.7, females, 75.5). The Madisonville femora also have much higher middle indices (right, males 92.1, females 94; left, males 89.2, females 95.7).

MEAN DIAMETER OF FEMUR AT MIDDLE OF SHAFT

	Turner Group mm.	Madisonville mm.	Munsee (Hrdlička) mm.
Males: right.....	27.6	28.2	27.3
“ left.....	27.9	28.5	27.5
Females: right.....	25.8	24.1	24.6
“ left.....	26.1	25.6	24.3

The males of the Madisonville series exceed the males of the Turner Group series in mean diameter of the femoral shaft at the middle, but the females of the Turner Group exceed the Madisonville females in this diameter.

The shape of the shaft is prismatic in 10 males and quadrilateral in 2 males. In 6 females it is prismatic. The development of the linea aspera is as follows: submedium, 3 males, 4 females; medium, 6 males, 2 females; pronounced, 3 males, no females. It is submedium in 25 per cent of males and in 66.6 per cent of females, and medium in 50 per cent of males and in 33.3 per cent of females. The linea aspera is, on the whole, better developed in this series than in the Madisonville series.

THIRD TROCHANTER

	Ridge				Fossa			Tuber-	Ridge and	
	Small	Medium	Large	Small	Medium	Large	osity	tuberosity	Total	
Primary series:										
Males	4	2	0	1	1	2	2	0	12	
Females . . .	2	1	0	0	0	0	0	1	4	

The third trochanter in some form appears in all of the males, and 4 of 6 females. In one female it is absent, and in one the subtrochanteric region is defective.

Bowing of the shaft is submedium in one male, medium in 8 males, and pronounced in 3 males. It is submedium in 3 females, medium in 1 female, and pronounced in 1 female.

Torsion is slight in 3 males, medium in 4 males, and pronounced in 4 males; slight in 2 females, medium in 2, and pronounced in 2 others.

A medium or submedium development of Poiret's facet on the femoral neck is present in 2 males and 3 females.

Tibia.

MEASUREMENTS

	Number	Mean length (minus spine) mm.	Mean middle diameters Antero-posterior (a)	Lateral (b)	Middle index $\frac{(b) \times 100}{(a)}$
Primary series:					
Males: right, paired	4	373	32.2	22.2	67
“ left, “	4	369	32.2	23	68.3
Females, right, paired	3	...	31.3	20.1	64.3
“ left, “	3	355.6	29.6	19.6	66.3

The number of tibiae available for measurement is so small as to be hardly worthy of consideration. The mean length of rights and lefts for males (371 mm.) would give a stature of 166.6, using Pearson's formula. The mean length of 3 female left tibiae, according to the formula for females, yields a stature of 158.4 cm. These are somewhat higher than the statures calculated from the femora. On the showing of these few specimens the males of our series have somewhat shorter tibiae and the females somewhat longer tibiae than those of the Madisonville series (males 376.4 mm., females, 347.2 mm.).

The mean tibio-femoral index on 6 odd pairs of male bones, both sides, is 84.25, and on 3 female pairs, 83.4. These indices are about the same as those given by Dr. Hrdlička for Munsee

and Louisiana Indians (tibio-femoral index: males, Munsee 84.45, Louisiana, 84.25; females, Munsee 83.7, Louisiana, 83.9).¹ Madisonville males average 83.1, and Madisonville females 83.8.

The middle diameters and the middle index show considerably more flattening than the Madisonville tibiae.

The shape of the shaft is quite variable. Prismatic and lateral prismatic types, quadrilateral types, and the type with the external surface concave occur.

The head of the tibia shows a slight backward inclination in 10 bones, a medium inclination in 3 bones, and a pronounced inclination in one bone. The external condyle is slightly convex antero-posteriorly in 7 bones, and concave in 4 bones. Slight "squatting facets" on the anterior lip of the inferior articular surface are found in 5 female bones and 2 male bones, and well-marked facets on 4 male bones.

The tibiae of one female are "boomerang"-shaped, and show inflammatory thickenings in the middle portions of the shafts. Similar inflammatory thickenings occur in the middle portions of the shafts of two other pairs of female tibiae. These bilateral tibial lesions are very common in Indian bones, especially those of females. One male tibia shows an arthritic condition of the superior articular surfaces.

Other Long Bones. Fibulae, and long bones of the upper extremity are too few in number in this collection to merit attention.

Vertebrae. Nothing unusual was observed in the spines of this collection. They are mostly incomplete and fragmentary. In two male specimens it was possible to secure the vertical lumbar index, which in one was 96.4 or kurtorachic, and in the other 102.9 or kailorachic.

Pelvis.

PELVIS AS A WHOLE

	Breadth maximum	Superior strait		Brim index $\frac{(b) \times 100}{(a)}$
		Breadth maximum (a)	Diameter antero-posterior (b)	
	mm.	mm.	mm.	
Primary series:				
Males: No. A 778	298	141	124	87.94
" No. A 628	294	124	100	80.65
Females: No. A 612	309	149	109	73.15

¹ Op. cit., p. 69.

	Mean height of innominate bones mm.	Distance between ischiatric spines mm.	Pelvic index
Males: No. A 778.....	219.5	91	73.65
“ No. A 628.....	208	88	70.74
Females: No. A 612.....	208	?	67.31

Only 3 pelves are available for measurement. Two of these are male and one female. They are all exceptionally large and capacious pelves for Indians. Especially remarkable is the great breadth between the iliac crests (outer lips). The total pelvic indices are extremely low because of this great width. The brim indices are all platypellic.

Sexual characters in these and in 4 other pelves upon which observations could be made are well marked. In the males the ischiatic notch is narrow in 3 cases, and medium in 1 case; the preauricular sulcus is absent in 2, and 2 others show slight traces; and the sub-pubic angle is small in 2 and medium in 1. In the pelves of 4 females the ischiatic notch is in every case wide, the preauricular sulcus is broad and deep in 3, medium in 1; and the sub-pubic angles are great in the 2 in which this feature could be observed.

Age changes in the pubic symphysis seem to conform in general with those established for male whites by Professor T. Wingate Todd.¹ The present writer is not confident of his ability to discriminate correctly between all the 10 phases which Todd recognizes, but in so far as he has been able to distinguish these phases they seem to correspond fairly accurately with the age estimates based upon other skeletal characters. Two male pelves were classified as phases 8 (age 39-44) and 9 (age 45-50) respectively; and 2 female pelves as phases 2 (20-21) and 9. One of the males, who had a phase 8 symphysis, was, however, judged to be old (over 50 years).

Summary. The crania of the primary series from the Turner Group show very slight occipital deformation in 5 of 21 specimens. In the secondary or intrusive series of 13 crania, 3 display slight occipital flattening, and one a medium occipital deformation. The males of the primary series are dolichocephalic in 58.3 per cent of

¹ Todd, T. Wingate, *Age Changes in the Pubic Bone, I, The Male White Pubis*, American Journal of Physical Anthropology, Vol. III, No. 3, 1920, p. 313 sq.

cases, mesocephalic in 25 per cent, and brachycephalic in 16.6 per cent. The females show higher proportions of mesocephals and brachycephals. The males of the secondary series are half dolichocephals and half mesocephals, with one brachycephalic deformed cranium excluded. The male crania of both series are hypsicephalic, except one orthocephal. Most of the cranial dimensions are moderate, but the minimum frontal diameter is extremely small in both series and in both sexes. The facial skeletons are mostly long and narrow in all of the series; none is short and broad. Nasal indices are prevailingly leptorrhine in the males, and half leptorrhine and half mesorrhine in the females. The orbits are mostly high in relation to breadth in the primary series, but variable in the secondary series. There is very little prognathism.

A narrow, low, and rounded frontal region is a marked characteristic of most of the Turner Group crania of both series. The primary series differs from the secondary series in that the former has the sagittal elevation more strongly developed. The temporal region is flat in both series of males and more convex in the females. All series show predominantly medium convex occiputs with little development of an occipital torus. The serration of sutures tends to be medium in the primary series, but simple in the secondary series. Brow ridges are generally small or medium in both series of males, and relatively undeveloped in the females. High and narrow noses seem to be prevalent in the males of the secondary series, and all varieties in the primary series.

The suborbital fossae are prevailingly medium or shallow, the malars and zygomae are medium or large, but larger in the secondary series. The teeth are in general, good, and show few abnormalities. Shovel-shaped incisors are characteristically present. The palate is U-shaped or parabolic in the males, and both of these forms as well as the elliptical form, occur in females. A medium or deep glenoid fossa with a moderately developed postglenoid process is usual in all of the groups, but the process is more often lacking in the females. The mandibles are moderately developed.

The males of the primary series seem to have been of medium stature, 165-166 cm., but the females are rather tall (157 cm.). The muscular development of the long bones of the primary series

is in general moderate. Very few pathological conditions were observed in the study of this collection.

The primary series differs from the secondary or intrusive series in many details. The former includes a brachycephalic element which is lacking in the secondary series, while the secondary series contains the one cranium which gives evidence of having been submitted to intentional occipital deformation. In most of the observed and measured characters there are differences between the two series which are possibly significant, but both series are so short that positive conclusions are impossible. In the opinion of the writer, the intrusive or secondary series probably represents a separate but allied Indian group, possibly a neighboring tribe. The primary and secondary series resemble each other much more closely than either resembles the Madisonville series.

It may be said positively that the people of the Turner Group show practically no physical affinities with the people who lived on the Madisonville site, beyond those which are common to all Indians. The affinities of the Turner Group people are rather with the Eastern dolichocephals, although there is present a brachycephalic element such as is often found also among the Eastern Indians. The Madisonville people were mostly brachycephalic and deformed, while the Turner Group people were mostly dolichocephalic and without cranial deformation. The Madisonville people had short broad faces and short broad noses; most of the Turner Group people seem to have had long narrow faces and long narrow noses. The muscular development of the Turner Mound people was superior to that of the Madisonville people, especially as regards the bones of the lower extremity, but the Madisonville males seem to have been slightly taller than those of the neighboring but older group.

The collection from the Turner Group is small, but sufficiently homogeneous to afford hope that it may be a representative sample of the people who were responsible for the remarkable culture which Mr. Willoughby has described.

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